PHOTOGRAPHY FOR AMATEURS.

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FOR

AMATEURS:

A Non-Technical Manual for the Use of All.

BY

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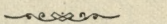
PREFACE.



The object in offering to public notice this brief Manual of Modern Photography, is to provide a practical guide for the use of the many amateur workers who, since the introduction of gelatine dry plates, have taken up the art as a pleasant occupation for their leisure hours. That some such guide was wanted will be evident when it is considered how many there are who wish to be able to take photographs, and yet have not the time to take up a subject which is popularly believed to bristle with all kinds of difficulty, and to require some knowledge of the mysteries of chemistry. That such a knowledge is necessary to the experimental worker must at once be admitted, but there are thousands of persons who simply require to know how to produce a passable picture. There are, too, many artists who are beginning to learn the value of the camera as an aid to correct sketching. With it they can secure details of a picture with marvellous accuracy almost instantaneously, which attempted with the pencil alone would occupy many hours of labour. But a busy artist could never

afford the time to master the details of photography unless the operations could be quickly learnt, and readily applied to his every-day work. I trust that my little book will be of service to the artist, as well as to his non-professional brothers and sisters. Thanks to the cleanliness of modern photographic operations, ladies can and do include the art among their other accomplishments.

I have to tender my best thanks to Mr. John Browning, Messrs. Marion & Co., Messrs. Dale, Messrs. Newton, and Mr. George Hare for the loan of woodcuts, which have materially helped me in my work.

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PHOTOGRAPHY FOR AMATEURS.

CHAPTER I.

INTRODUCTION.

THE history of the art of Photography is the record of the patient labours of many different men—who, many of them unconsciously, were making the bricks for a structure which was some day to reach the most surprising dimensions. In endeavouring to trace this history, the inquirer will speedily notice that it tells of two distinct armies of busy workers, one of which devoted itself to the optical part of the art, and the other to the chemical part. The first contributor to the optics of photography was a clever Neapolitan philosopher, who flourished in the second half of the sixteenth century. His name was Baptista Porta.

Baptista Porta was the inventor of the contrivance known as the camera obscura, which, in its first form, no doubt, merely consisted of a darkened room, with a white screen inside, upon which the image of the outer landscape was projected through a small hole in the shutter. That such a simple arrangement will produce an image may be very easily proved by any one who cares to do so. A box may do duty for the dark room, and the image, projected through a

tiny hole pierced in the bottom, may be plainly seen if a piece of tissue-paper or ground glass be placed across the opening of the box for its reception. In its more elaborate and modern form, the camera obscura usually consists of a dark room or tent, about ten feet in diameter, and with a dome-shaped roof. At the top of this dome there is an opening, furnished with a lens and a sloping mirror above it—a mirror which, turning on an axis, can be made to face any portion of the surrounding country. The image, by means of this mirror, is reflected downwards through the lens upon a whitened table below, on which the landscape appears in all its natural colours. Sometimes a prism is made to do duty for both lens and mirror.

Although the camera obscura may be said to have had its day—for we now meet with it only occasionally at some show place, as the Crystal Palace—it was once in far greater use. Country houses, before they were brought by means of the railways within a few minutes' journey of our large cities, were often provided with a camera obscura as a means of amusing their inmates. But the instrument, in the portable form of a tent, became a great favourite with artists as a help to them in sketching from nature. A tent, with its mirror and lens, and a folding table, upon which could be spread a sheet of drawing paper, did not present a very heavy burden, and the artist could quickly trace on the paper with his pencil the exact outline of every image cast upon the paper by the lens above.

Among the artists who availed themselves of this

help was Daguerre. He aimed at getting telling effects in a rapid manner, and the camera obscura was just the thing to be of use to him. In the year 1820, Daguerre had already become famous in Paris as a scene painter at the Opera-house, for he produced effects of light and colour that had never before been seen in a theatre. A few years later the people of the gay capital were flocking to see his wonderful diorama, and trying to guess how the marvels which they saw were accomplished. There is no doubt that the constantly changing views of the camera obscura, to which Daguerre had accustomed his eyes, had much to do with his success as a scene painter. But his labours with that instrument were destined to accomplish a far greater work than the mere passing amusement of the gay Parisians. They were gradually laying the foundation of the art of photography which can only be looked upon as one of the grandest discoveries of the century.

While Daguerre was dreaming of some means by which he might succeed in making the evanescent pictures of the camera obscura permanent, there was another earnest worker in the same field, who, quite unknown to Daguerre, was making some noteworthy experiments at Châlons-sur-Sâone. Nicéphore Niepce was one of two brothers, who, besides contriving many useful models of various machines, had devoted much time to the phenomena of the camera obscura. One brother had at this time come to London, but Nicéphore remained at Châlons, and to him only it will be necessary here to refer. He was first of all attracted

to the then new art of lithography, and in the constant endeavour to produce like effects by the aid of the camera, he made a remarkable discovery. He found that when bitumen of Judea was exposed to the action of light, it became insoluble in the usual menstrua; so that by placing a drawing or engraving, previously varnished to make it transparent—over a metal plate covered with a thin layer of bitumen, and exposing the whole to the sun, those parts of the bitumen unprotected by the lines of the drawing could afterwards be dissolved out by a bath of essence of lavender. By placing such a plate in a camera, the light from the lens had a similar effect, and a veritable photograph, such as it was, was obtained.

These experiments are now but of historical interest. Niepce's pictures on metal plates were but crude productions, for the bitumen employed is so very slowly acted upon by light that a picture under favourable circumstances occupied several hours in its production, during which the lights and shadows of the subject changed their positions so much, that a foggy and ill-defined result was inevitable. One valuable process, however, resulted from these experiments. Taking a metal plate, upon which one of these bituminous pictures rested, Niepce showed that it was possible by means of acid to etch away those portions of the metal not protected by the bitumen, and afterwards to use the plate in a printing-press. This is the foundation of that beautiful method of producing pictures which comes under the head of Heliography.

Eventually Niepce and Daguerre met, and after some little time they proposed, as both were engaged in the same kind of research, to enter into a sort of partnership, and to acquaint each other with their methods of working. But nothing came of this arrangement, and both apparently were content to work independently. Daguerre continued to give his mind to chemistry, trying compound after compound without any definite success, until one of those strange accidents which will sometimes occur just in the nick of time gave to Daguerre a hint which quickly led him to the goal of which he was in search. Upon a silver plate which he had treated with iodine he had carelessly left a metal spoon. Upon raising that spoon some time afterwards, he found its image clearly impressed upon the plate. From this he learnt that iodide of silver was sensitive to light, and after a few more experiments the so-called Daguerreotype was introduced. In this process, a silvered plate, treated with iodine, is exposed to the action of light in the camera, and is afterwards developed by the fumes of mercury. Almost at the moment that success was achieved Niepce died.

Whilst these events were occurring in France, there were in England some interesting experiments going forward which had almost as much to do with the birth of photography. We have seen that the first contribution to the optical part of the science was Baptista Porta's camera obscura, in the sixteenth century. About the same period it had been found out that white chloride of silver would darken if

exposed to light. This one little fact was the only bit of photographic chemistry known for two hundred years, when we find Scheele, the Swedish chemist, experimenting with chloride of silver, and producing a rough picture by its aid. He covered a flat surface with the compound, and by means of a strong light cast the shadow of a person's profile upon it, with the result that all those portions of the surface not protected by the shadow turned black, the rest remaining white.

Scheele was also the first to point out that the yellow and red rays of the solar spectrum had little or no effect upon this compound of silver, sensitive to ordinary light. Wedgwood, in 1802, took up the thread dropped by Scheele, and in the course of a paper contributed to the Royal Society, described a new method of copying pictures. Paper, dried after immersion in a solution of common salt (chloride of sodium), is brushed over with a solution of nitrate of silver, with the result that a sensitive surface of chloride of silver is formed on the paper. By placing over such a surface fern-leaves, pieces of lace, &c., and exposing them to sunlight, Wedgwood produced a variety of pictures, such as Scheele had done before him—white on a dark ground. But he did not succeed in making these pictures permanent. Unless kept in the dark, the white portions, under the action of diffused light, slowly became blackened, until nothing worthy of the name of a picture remained. It was not until many years after that Herschell, the great astronomer, pointed out hypo-

sulphite of soda as a fixing agent, and as such it is used to the present day.

In 1839 Daguerre gave his invention publicity; but Fox Talbot, in England, had before that year been experimenting in the direction of obtaining pictures on paper. Repeating the experiments of Wedgwood, he succeeded, by means of his camera, in producing pictures of external objects by long exposure of the prepared paper to the action of the lens. He has left a curious and interesting account of the manner in which he placed roughly-contrived cameras all round his house in the summer of 1835, and obtained successful pictures thereby. He naïvely says: "To the traveller in distant lands who is ignorant, as too many unfortunately are, of the art of drawing, this little invention may prove of real service." Later on, by means of iodised paper treated with silver, Fox Talbot introduced a really serviceable process. The paper pictures so produced he called negatives, for the lights and shadows were all reversed. To obtain a positive picture in sunlight, he placed prepared paper beneath the negative, so that those portions beneath the clear portions of the negative were darkened, and those beneath the opaque parts remained white, for the light could not get to them. He thus obtained exactly the reverse effect from a superimposed negative. These terms negative and positive were first used in connection with photography by Talbot, and they retain the same meaning now as then.

Passing over many minor inventions, we reach the year 1851, when a most important improvement

in photography was announced by Scott Archer, which, under the name of "Wet Collodion Process," has produced the perfect pictures to which we have been accustomed in modern times. In this process glass is employed as a basis for the future picture. It is first of all covered with a varnish-like compound, called collodion. This is a solution of gun-cotton in ether and alcohol, which, for photographic purposes, is charged with certain iodides and bromides. The glass thus collodionised is dipped for several seconds in a bath of nitrate of silver, so as to allow the dissolved iodide and bromide in the collodion to form iodide and bromide of silver, and thus present a surface highly sensitive to light. In this state the glass plate is transferred to the camera, and by exposure to light a negative invisible picture is produced, which is afterwards rendered visible by development with a solution of an iron salt.

Such, briefly, is the wet collodion process of Archer, which for more than thirty years has been the sheet anchor, so to speak, of the professional photographer, and which only lately has been partly superseded by a more convenient method. With all its advantages, the wet process suffered from one or two serious drawbacks, which almost restricted its use to the professional man, whose business it was to make the best of them. But many amateur workers arose, who, luckily for the art, had money and time to experiment—who thought that a means could be found for producing plates and using them dry. (In the wet process the plates

must be used at the time they are prepared, or they are worthless.) Such a plate would, they argued, do away with the mess and stained fingers inseparable from the use of a bath of nitrate of silver, and would be a great boon to those who, travelling in foreign lands, could only, with the old process, produce photographic pictures under the penalty of being accompanied in their journeys with a movable chemical laboratory. With this idea dry processes were one after the other invented. Some of these gave very beautiful results, but yet not good enough to tempt the professional photographer from his old groove. At last one or two enthusiastic amateurs began to tell of the wonderful pictures obtainable by using gelatine as a medium for holding the sensitive salts; and when, shortly afterwards, pictures taken by the new method were exhibited, the professional photographers suddenly awoke to the advantages it offered, and the old wet process found a formidable rival before it.

In the gelatine process, the sensitive salts (such as the bromide and iodide of silver) are mixed with warm solution of gelatine, and spread upon plates of glass. When dry, the plates are ready for putting into the camera, or they will keep indefinitely. It is at this point in the history of photography that it is intended in this little book to take the matter up practically. Although, as I have pointed out, the art is indebted to amateur workers for its most recent improvements —as, indeed, it has been indebted to them for many past discoveries—it was not until the introduction of

dry plates that photography could be conveniently practised as a pastime by amateurs generally. Many of those who did dabble in it speedily became disgusted with the constant mess, trouble, and expense which it entailed. But now all is different. The tourist can carry in a knapsack all that is required for outdoor work, and can postpone the operation of developing his pictures, in which bottles and dishes necessarily come into play, until the end of his travels, and when he is again at home.

A few brief notes dealing with the history of the gelatine process may be found interesting. In the year 1871, Mr. R. L. Maddox produced some very beautiful pictures by means of gelatine emulsion. A great many amateurs worked in the same direction, but on all hands the process was considered a slow one—much slower, indeed, than collodion emulsion, which was then the most favoured dry plate method in use. Soon afterwards Mr. R. Kennett began the manufacture of gelatine plates commercially, and it is a significant fact that he had to adopt precautions to keep them slower than they naturally were, so unused were operators to anything quicker than the old wet collodion process. Suddenly Mr. Charles Bennett published an article, in which he gave details for making very quick emulsion: the secret in the matter consisting of the simple process of slowly ripening the finished emulsion at a gentle heat for several days—the longer the period, within certain limits, the more rapid the product. There are not a few plate-makers who still hold to this plan, and

assert that by it they gain a quality of plate not otherwise attainable.

The next advance was the publication of the circumstance that the same effect could be produced in a few hours by the simple expedient of boiling the emulsion; but whereas the heat would be certain to prevent the gelatine from properly setting when cold, a portion only of it is mixed with the silver and bromide, the greater proportion being added afterwards, when the emulsion is somewhat cooled. Other published formulæ take advantage of the fact that ammonia added to the emulsion also shortens the time of preparation, but in this case the heat must be limited to a much smaller amount, or general decomposition occurs.

CHAPTER II.

CHOICE OF APPARATUS.

It is a very difficult thing to advise an intending purchaser what to buy, and how to buy it, without having a preliminary peep into his purse, to see how much money he can devote to the purpose in hand. The old hackneyed directions which the writer of a book is almost forced to give must once more serve its purpose here. Go to a reputed maker, tell him how much you intend to spend, and be guided by his advice. The beginner must have certain apparatus to begin with, and the better and more complete the outfit, the more complete his work will be. But just to show what can be accomplished under difficulties by a determined man, I may state that a friend of mine, serving during the Zulu War in South Africa, brought home several photographs—and presentable ones, too—which had been taken with some hastily-made apparatus that had never seen the inside of an optician's warehouse. The camera was made out of a cigar-box, and the lens came from an old telescope.

Here is a list of the articles required for ordinary landscape photography, leaving out all mention of chemicals and appliances wanted in the after treatment of the plates.

A camera and lens.	A focussing cloth.
A portable tripod stand.	Some gelatine plates.

A red lamp.

The ingenuity which has been spent upon photographic apparatus, particularly since the introduction of gelatine plates, is very remarkable. It is a matter of no small interest to trace the progress which has been made from the first simple camera, like that shown in Fig. 1, where one box

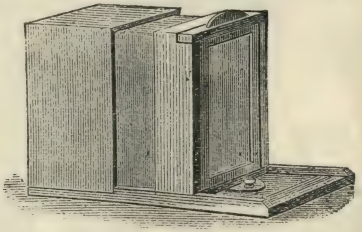

Fig. 1.—Simple Camera.

slides into another, and so enables the picture to be focussed, to the elaborate instruments of the present day, which fold up and pack into such a small space that they add little to a tourist's impedimenta. In order that this folding may be accomplished without difficulty, modern cameras are made with bellows bodies, just like an accordion, and pull out or shut in as may be required. This movement may be effected by a screw action with a handle at the back (as shown at Fig. 2), or by a rack and pinion arrangement, with a knob to turn at the side. It is as well to purchase a camera that will open out to a great extent, for it

may on some occasions be desirable to use a lens of great focal length. Sets of apparatus are now sold at various prices, which pack up in a leather case in the most compact manner, and can be carried with ease

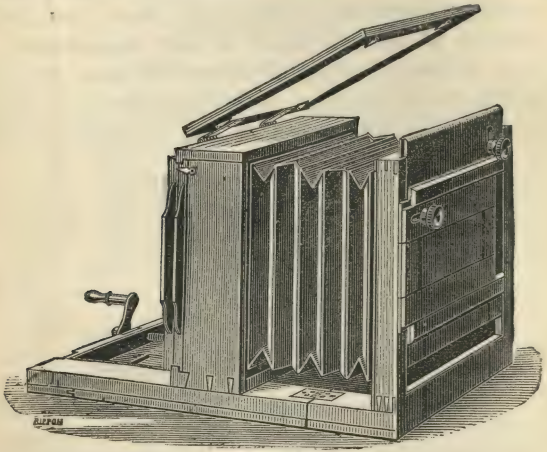

Fig. 2.—Folding Camera.

in one hand (*see* Fig. 3). Those who know what it was to work in the field with the old wet plate process, with its bottles of chemicals and dark tent and mass of luggage, that fully burdened two men at least, are apt to exclaim at the advantages which the gelatine worker possesses, in being quite independent of anything but what his own hands can carry.

Whatever be the exact form of the camera, it must possess a screen of ground glass at the back, upon which the image formed by the lens is received.

In the majority of cameras this screen is hinged so that it can, as depicted in Fig. 2, be folded over the top of the instrument when the picture has once been

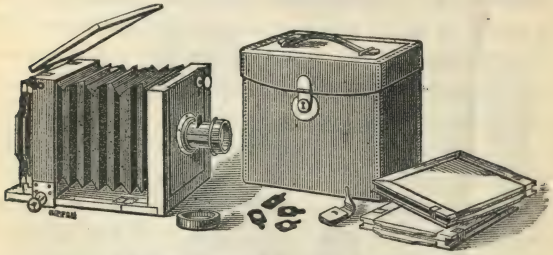

Fig. 3.—Tourist's Photographic Set.

focussed. It is necessary to get it out of the way, for the exact place which it formerly occupied must be taken by the sensitive gelatine plate, upon which the same image which just now fell on the ground glass is destined to impress itself. The most common method of conveying a gelatine plate to the camera, for the purpose of taking a picture, is by what is called a dark slide. These slides are now made double, so as to contain two plates each, and three of these double slides are commonly supplied with every camera. Supposing that we wished to take a couple of views only, we should take up the slide marked 1 and 2 on each side respectively. Then having focussed the first view, the ground glass screen would be folded back, and the slide would be put in its place, where there is a groove to receive it. The slide marked 1 would be made to face the

lens. Then when the next view is taken the slide is simply turned round, so that No. 2 faces the lens. Each side of the slide has its own shutter, which can be withdrawn when in position in the camera, so as to expose the sensitive surface within to the action of the lens. When only a few pictures are required to be taken, there is no better arrangement than this of double slides.

There are several other plans, however, by which the dry plate can safely be transferred from its original containing box to the camera without meeting with white light, which, of course, would at once spoil it. Here is the picture of a changing box which I have used for several years, and would not willingly part with. (*See* Fig. 4). The way it works is as follows:

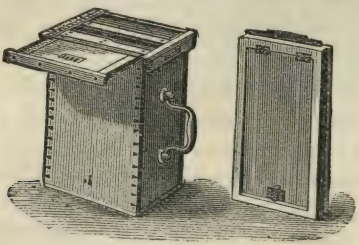

Fig. 4.—Changing box.

Before leaving home on a photographic tramp, I take the box into my dark room, unlock it, remove the sliding bottom, and carefully dust out its interior. Here I see twelve grooves, which I proceed to fill with gelatine plates—a plate in each, and all facing one way. The box is then locked, and I am ready for

work. A special dark slide is used with this box—a slide which fits into a groove upon its top surface. As soon as the slide is adjusted on the box—which is the work of a moment—communication between

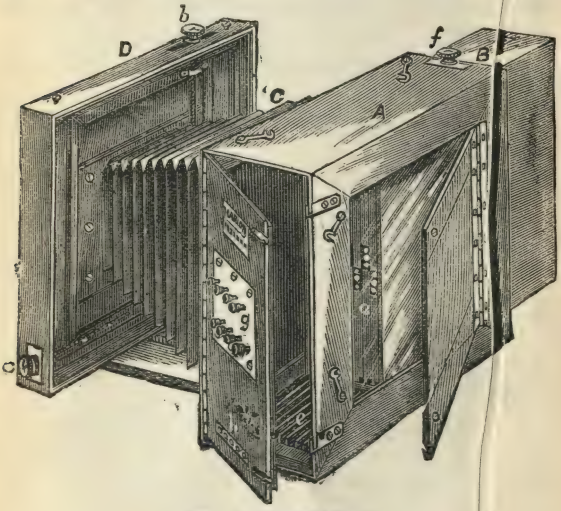

Fig. 5.—The Enjalbert.

the two is automatically opened; the box is inverted, and you hear the gelatine plate drop from No. 1 groove into the attached slide. You then take your picture, and return the plate to its old position. By shifting a simple sliding arrangement attached to the box, you can severally expose the whole of the twelve plates. The entire contrivance works most perfectly.

In the form of camera named after its inventor "The Enjalbert" (*see* Fig. 5), a separate container for the plates is dispensed with, for the camera itself holds a consignment of eight. These by a mechanical arrangement are alternately submitted to the action of the light.

Another ingenious and lately-introduced method

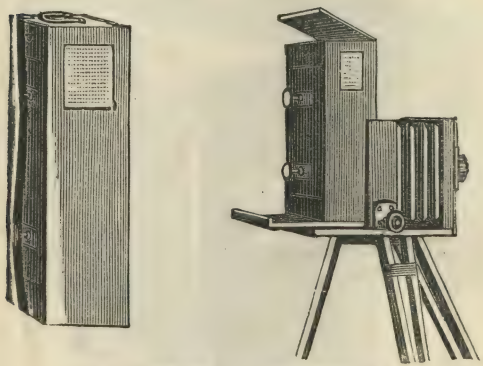

Fig. 6.—The Multiplex Camera and Back.

of changing plates in the field is the multiplex back represented at Fig. 6. On the left-hand side is seen the multiplex alone; on the right it is shown attached to a camera—taking the place, in fact, of the usual dark slide—with its shutter upraised ready for action. In a larger cut (Fig. 7) is shown in detail the way in which the thirteen plates which the apparatus holds are disposed. There are, to begin with, thirteen loose wooden frames, each furnished with a

japanned metal screen, and buttons for fastening a gelatine plate in front of that screen. These frames

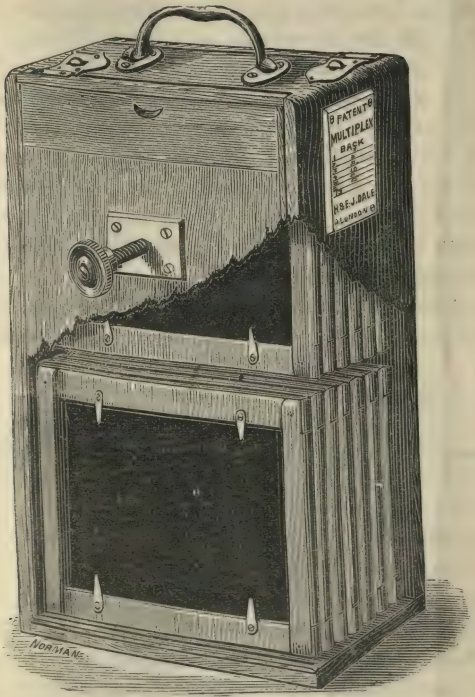

Fig. 7.—Section of Multiplex Back.

are arranged in two separate tiers, as shown. One tier will be occupied with seven plates and the other with six, there being room in the latter for one more.

If now the operator turns the box completely over, the blank space in the one tier is immediately filled with a frame that drops down from the other tier; so that if the movement be repeated thirteen times, each plate in succession will so drop down, and in its turn will be in the front of the lower tier ready for exposure. Each frame bears a number, and by means of a little window of red glass the particular number of the frame next the shutter can always be seen by the operator. The box is further provided with an ivory tablet, upon which the number of plate exposed can be marked in pencil.

One of the first considerations with the beginner will be the choice of the particular-sized picture which he will adopt. This is a more important point than it at first sight seems. The price of a large-sized camera is not in itself so much more than the price of a small one, for the cabinet-work in each is much the same. Indeed, we might almost say that the smaller the camera the better workmanship it will require; and therefore its price is necessarily brought near apparatus of larger kind. But the price of a lens rapidly increases with the size of the picture which it will give. Then the price of the plates, the developing dishes, and the chemicals required also becomes an increased burden when a large-sized camera is adopted. In a word, the expense of taking large pictures, from their first impression in the camera to the final operation of printing them, is very great. As a case in point, let us see the number of prints obtainable from a single sheet of sensitive paper. If we are content

with *carte* pictures, we can manage to cut forty-two from the sheet; but if we aspire to 10×8 pictures, we shall only get four. I believe that one of the best sizes to begin upon is 5×4 inches. This will give a compact camera, and double slides or changing box, which can be easily carried without fatigue. I have been in the habit of carrying a $7\frac{1}{4} \times 4\frac{1}{2}$ camera, which, with its accessories, is certainly rather heavy for a ten or fifteen miles walk. For this reason I am now putting it aside for a smaller apparatus. There is one more consideration to urge in this connection: small pictures can always be enlarged, and the means of doing so are well within the capabilities of an amateur worker, as I shall endeavour to point out in another chapter.

With regard to the lens to be employed, a few words are necessary. If the amateur intends to confine himself to landscape, with an occasional attempt at portraiture, he can get on very well with a cheap single lens. This simple lens has many advantages; but it has the drawback of bending straight lines, and therefore it cannot be used for architectural subjects: but, at any rate, the lens is a capital one for a learner. When he gets proficient in the work, and possibly compares notes with other amateurs whom he will meet at home and abroad, he will soon perceive that there are really only two descriptions of lenses used for out-door work. One is known as the "Rectilinear," and the other as the "Symmetrical." They are really very much alike in construction, and both give, as the name of the first-

mentioned implies, perfectly straight lenses. In my own practice I carry a rapid "rectilinear" of about $6\frac{1}{2}$ inches focus, and a "portable symmetrical" of much shorter focus, both screwing into the same flange on my camera. If circumstances compel me to be so close to my subject that the image as formed by the first lens is much too large, I screw on the second one in its place, and take my picture with that.

Most beginners will be anxious to take what are called "instantaneous pictures," but they will be wise not to attempt them till they have mastered the simpler mysteries of the craft. Both lenses and plates are so rapid in their action now-a-days that there is no great difficulty in this branch of work when the amateur is really proficient with ordinary photography. It is seldom that an instantaneous view forms a really satisfactory picture. Rowing and yachting matches, and river and sea-scapes generally, form the best subjects for such work; but they require both skill and experience, as is evidenced, I think, by the really small number of such studies that have been published.

There are several capital forms of tripod-stand in the market, but some are better than others. The properties which a good stand should possess are lightness, compactness, absence of screws or other loose parts, and, most important of all, extreme rigidity. A rickety stand is an abomination, with which a good picture cannot be taken; and in cheap sets of apparatus the stand is generally the most faulty accessory. Some stands are firm enough; but

they require so much putting together and adjustment of screws that, by the time the camera is mounted, the object for which it was unpacked has disappeared.

I need not say much about the focussing-cloth. By all means have a good-sized one—say a yard and a half square. Some people rejoice in one made of velvet; but I have found one of a cheap material, called "Silesia," to answer every purpose. If it gets mislaid or lost, it need not be mourned over, as a more gorgeous velvet one might be. If the cloth be furnished with a few buttons on one edge, and some corresponding loops on the other, it can be fastened securely to the camera on a breezy day, when the wind threatens every minute to send it flying.

Of red lamps there are many patterns to choose from. For studio work, by all means have a paraffin one with a proper light-tight top and a red chimney, which can be further protected by screens of orange-paper. But for field-work, when the operator is travelling from place to place, and sleeping at hotels at night, where he will want to change plates, and perhaps to develop one occasionally, he will want something of a far more portable nature. There is nothing better than the lamp shown at Fig. 8, and it has the merit of being easily home-made. To make it, you must procure three pieces of stiff cardboard, each measuring 12 × 7 inches. In one of them cut a window. This

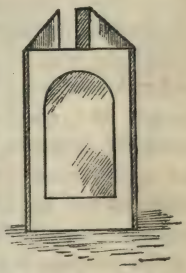

Fig. 8.—Cardboard Travelling Lamp.

window must be filled in with either ruby medium, or bookbinder's cloth of the same colour. (This material, by-the-bye, is most useful as a screen for photographic operations, two thicknesses over an ordinary window being ample protection.) Fix the medium to the card by means of thin glue, and hinge the three pieces of card together—the window one in the centre—by glueing strips of the medium over each join, both back and front. Before the glue is dry, see that the arrangement folds up perfectly flat. Then glue one more strip of the cloth over one side of the remaining join, so that when the whole arrangement is standing up, with a candle burning in the centre, no light will come through the open join at the back. A triangular piece of tin, with the corners cut off to give ventilation—which can be wrapped between the folds of the lamp when travelling—completes the contrivance. A little light will be emitted from the ventilation spaces and reflected from the ceiling; but this does no harm. Should the amateur photographer propose to visit northern latitudes, where the daylight is continuous for many months of the year, he will want another arrangement for changing his plates, unless he can secure a specially darkened room. What I recommend for the purpose is a dark tent with a red window in it to fit over the tripod-stand. This, without its camera, should be put on a table, and crowned with the tent. The operator can then put his head underneath, and work with comparative comfort.

Fig. 9 represents what is known as an "instantaneous shutter," of which many different forms are

now made. It is only used for taking pictures of moving objects, which must necessarily be done in a fraction of a second. It is usual to employ the full aperture of the lens for such pictures; but with *very* rapid plates the lens must be stopped down even in giving one of these short exposures. However, this perhaps would only be the case under the very best conditions of light. The most simple shutter is of the drop form: that is to say, a screen having an orifice in it falls either in front or behind the lens, and so allows the light to get in while the aperture is passing. The movement can be hastened by the use of an india-rubber band acting as a spring. I have already dissuaded beginners from taking rapid pictures among their first attempts. Still, they may occasionally come across subjects in which the use of a shutter is desirable. Waterfalls, ripples on water, breaking waves, &c., will form good objects for first practice.

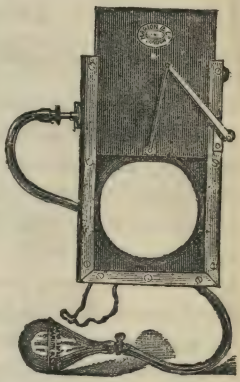

Fig. 9.—Instantaneous Shutter.

CHAPTER III.

LANDSCAPE PHOTOGRAPHY.

SOME years ago, when on a walking tour in Scotland, plodding along mile after mile over hill and dale, with my knapsack on my back, I was pleased to find how well I was repaid for trusting to my legs instead of taking a seat on the top of a coach, which most tourists prefer to do. Instead of having to be content with a mere peep at some roadside cottage or mountain stream as the coach flew by, I could pause on my way and drink in all the beauties of the scene at leisure. Along the pass of the Trossachs I found especially lovely little nooks, which seemed never to have been trodden by human foot. I need hardly point out how valuable such picturesque "bits" are for the purposes of photography. So let me advise all who take up the camera as a pursuit to become tramps as well. They will get far more enjoyment from an outing, to say nothing of the accession of rude health. There is always an advantage, too, in having a purpose in view beyond mere pedestrian exercise. The gun or the fishing-rod fulfils this office for many, and sportsmen have the added gratification of killing something—a trait in the British character which seems to be inherited from our ancestral cave-dwellers. For my part, I think that the photo-

graphic camera is perhaps the best and most entertaining dumb companion a man can have. It certainly gives a very distinct object to an excursion. Like a living thing, it must be fed, but its food, instead of being costly to its owner, furnishes him with an intellectual feast of no mean character. The varied beauties of Nature are not merely scanned as they happen to present themselves, but are eagerly sought out. They are then studied, viewed from different points, until one or another aspect is selected. The camera is now brought into action, and if in the hands of an experienced man, the view is focussed on the ground glass, and the picture is taken in a minute or two.

The whole thing seems so ridiculously easy to an onlooker. The machine is set up on its three legs, covered with a black cloth, which presently also enwraps the operator's head. The head is next withdrawn, and its owner places his hand under the cloth to manipulate something or other; he then removes the cap from the lens for a second or two, and the picture is taken. The modest individual who, in answer to the question whether he could play the violin, replied that he did not know for he had never tried, would probably have given the same reply had the questioner asked him if he could take a photograph. It certainly looks as easy as violin playing, and, luckily for its votaries, it is a great deal more so. But for all this, let not the tyro imagine that because he has obtained the best and most costly apparatus that money can buy, that, as a matter of

course, he is at once to blossom out into a competent photographer. I know more than one fortunate possessor of such things who has never taken a presentable picture, and I don't believe ever will do so. They lack the patience and application necessary for the work, and, unfortunately, money will buy neither the one nor the other.

The success of a landscape photograph mainly depends upon the judgment with which the subject is chosen. The beginner will be apt to fall in love at first sight with any picture which he may focus on the ground-glass screen of his camera, and will probably imagine that as it looks so beautiful it is sure to make a fine photograph. But let the experienced worker peep over his shoulder for a moment, and whisper to him that the picture, pourtrayed in all its natural colours as it is, will look very different as a mono-chromatic photograph. Those moving clouds, with all their tender hues, and their lovely blue background, will, in the photograph, be represented by a blank white space. The brilliant carpeting of green will be almost black. That hedge bounding the field will, in the picture, be represented by a still blacker mass, forming an ugly band, separating the sky from the earth. In a word, the beginner wants educating by experience into what will and what will not make a good picture.

Unfortunately, the power of really appreciating nature is much rarer than many people imagine. How many are there who seem to have no idea of noting the natural beauties of spots which are

constantly before their eyes! One may perhaps cross the bridge over a canal every morning on his way to work, and will be familiar with the sight of the laden barge, and the patient horse toiling on the towpath dragging it along. He may take the trouble to look at the scene, but he would laugh at the idea of there being anything beautiful about it. But show him a photographic print of the same view. He will be delighted at it; he will say that he never saw anything so beautiful. Then he will notice for the first time the ripples on the water; the reflected shadow of the girl steering the boat; the light tint of the load of straw, relieved by the dark sail lying upon it: in short, he will for the first time see an artistic picture, which, when presented to him in all the wealth of colour which nature's palette affords, and with all the poetry of movement which belongs to living things, he had looked upon with a blind man's eyes.

Now, there are thousands of persons in the world who are like my imaginary friend of the canal. They require a surgical operation before they can be made to see a beautiful picture which is immediately before their vision. They have altogether failed to cultivate the power of observation. To this education of the eye, the would-be successful photographer must apply himself. Education of a particular sense is quite as necessary to the worker who depends for success upon the exercise of that sense as education of the hand is to the skilled artisan. Let the beginner get into the habit of studying the effects of light and shade, the

different appearance of a familiar landscape under morning and afternoon light, the manner in which a broad expanse can be broken up and rendered picturesque by the presence of objects in the foreground, and so forth. Let him, if he have access to a picture gallery, study the way in which artists treat their subjects, and he will soon educate himself into the power of *seeing* a picture which others will have passed by and missed entirely.

It is a great advantage, when possible, to go previously over the ground covered by a projected camera excursion, and to make notes of views to be taken. I had an opportunity of doing this once, and I have always remembered the lesson which it taught. An entomological friend of mine, who knew the neighbourhood of Dorking well, invited me to accompany him on a tramp through the most beautiful scenery of the district. Shortly after starting on our day's excursion, it came on to rain, and it rained persistently all day. But we walked through the wet, and most thoroughly enjoyed ourselves. While my friend paused to hunt up some poor wretched beetle, which would afterwards figure in his cabinet with a pin through its internal economy, I was busy making notes of views to be taken on a subsequent occasion. A week afterwards I went over exactly the same ground alone, with my camera and changing box. I took twenty-four pictures, and nearly every one was a gem. I have often exhibited these Dorking views in public with the lime-light lantern, and have received many letters of inquiry as to where the exact

spots are to be found. One gentleman wrote to say that he had lived many years at Dorking, but only recognised one of the pictures—an unmistakable waterfall. Does not this bear out what I have written about the man crossing the canal?

Some of the various manuals on sketching from nature give certain rules for the composition of a picture, and commonly divide their discourse, like an old-fashioned sermon, into three heads. These consist of distance, middle distance, and foreground. I do not believe that any hard-and-fast rules are possible in such a case, for each picture is different. Still, there are a few rules which must certainly be observed by the photographic artist if he wishes to produce pleasing results. For instance, he should not attempt a picture facing the sun. On one or two occasions I have wanted to photograph a church, and the only point of view available has been with my face towards the sun. In such a case the lens must be shaded with something—a hat will do—to prevent the rays actually entering the camera. The horizon should be kept at such a height in the picture that there is neither too much sky nor too much ground. Some persons recommend that the horizontal line should be one-third from the bottom edge of the picture; but, as a matter of fact, the height should vary according to the subject. If, for instance, we take a view from a hill-top, where we have a wide expanse of landscape, with a river or lake, plenty of wood, and one or two buildings, the sky need only be a mere strip. If we give it much room, then we

lose space for foreground, and lose entirely the effect of distance and expanse.

Let us now suppose that the tyro has started upon his first photographic excursion, with his camera, tripod, and changing box, or double slides, which have been charged with plates by the red light of the dark room, and that he is eager to get to work. He should carry with him, in addition to the actual necessaries, a note-book in which he can dot down particulars of each plate used. Such notes should contain particulars of lens, if more than one is in use, of the number of the stop employed; the exposure in seconds; the time of day, the date, and notes regarding sunshine, cloud, etc. Such notes, when afterwards studied by the side of the negatives to which they refer, will be of immense assistance in correcting faults. One fact he will quickly learn from them will be that the photograph of a given subject, taken under morning light, will require about double the exposure if taken an hour or two after noon. The same difference will be apparent between spring photographs and those taken in late summer. One more adjunct to this paraphernalia should not be omitted by the worker with double backs. Let him have some strips of gummed paper, from the edge of postage stamps, and as each plate is exposed and shut up in its slide, gum a piece of paper over its shutter, as a reminder that it must not again be moved.

Having chosen a subject, fasten the camera on its tripod on the ground at the selected point of view.

Do not attempt at first to look through it; but look along its top, so as to get it as level as possible. Let the stand be so adjusted that one leg of the tripod is projecting at the back. Now cover the camera with the focussing-cloth, remove the lens-cap, select the largest stop—or use none at all—and look at the ground-glass, and extend the camera until the inverted image appears as sharp as possible. It will be found that to get objects in the foreground in focus, the camera will have to be extended further than for distant objects, so that to obtain both quite sharp, a stop must be inserted. The largest that will give the desired definition should always be used. If the picture has too much sky, or the opposite fault, the back leg of the tripod can be gently moved forward or backward, as the case may be. But if the objects represented do not fall in their desired places, but must be more to the right or left, do not shift the tripod, but loosen the screw which attaches it to the camera. The latter can then be turned about as desired, until the best aspect is secured. It will happen very often that a tree or building, which is relied upon as an important feature in the foreground, will look so big on the ground-glass as to more than cover it. In such a case, the tripod must be moved bodily back until the image is reduced to more moderate size. Sometimes a high wall or other obstacle prevents the photographer from retiring to a suitable distance from his subject, in which case a lens of shorter focus must be used.

When the subject has been duly focussed, the

ground-glass screen must be removed, the dark slide introduced in its place, and the lens capped. The latter must now be furnished with the particular stop chosen,* and now all is ready for exposure. Cover up the camera as much as possible (it is a good plan to have an indiarubber band fastened to one edge of the cloth, which can be slipped over the lens), pass the hand underneath the focussing-cloth, and gently withdraw the shutter of the slide. Now look at your subject. If a puff of wind comes and shakes the leaves, wait with your hand on the lens-cap until it has passed. Do the same if a figure moves across, if you cannot induce it to stop still for a moment to add interest to your picture. Now remove the cap for a second, or more as required, and again replace it. Push in the shutter of the slide, gum a piece of paper across it, and look out for your next picture.

Remember that correct exposure is the first thing to aim at. Mistakes in this respect may be greatly obviated by cautious development; but nothing is so good as the right amount of exposure in the first instance. It is by no means an easy matter at first. To give an idea of the wide latitude that must be observed according to the amount of light available, I may here quote an experience of my own. On one occasion I was asked to photograph the interior and exterior of a large house. One of the interior views was a magnificent hall, with dark panelling, relieved

* It should be borne in mind that a diaphragm or stop having an opening of $\frac{1}{4}$-inch diameter, will require four times the exposure necessary with a $\frac{1}{8}$-inch aperture.

by armour, the whole being bathed in a very subdued light. With a very rapid plate, I gave my picture an exposure of two-and-a-half *hours*. I then went outside the house, and took a view of the exterior, using the same stop and description of plate. The exposure now was just two *seconds*. Both turned out to be first-class negatives. This, of course, is a very extreme case; but it shows how the exposure must be regulated by the light available.

I always recommend my pupils to commence by using only one stop of their lens, and to stick to that until they can judge of the exposure required under different lights and according to the class of subject. I also advise them to use at the same time one make of plates. I am certain that many amateur workers fail because they will persist in using different makes of plates. They perhaps admire the work of some more competent friend, when their first question is, "Whose plates do you use?" The answer is given, and straightway a batch of the recommended plates is procured; but the work turned out by their aid is no better than before. I believe, although some commercial plates are better than others, that all are good. The man who supplied faulty ones would quickly lose his custom, and would drop out of the race. The beginner will do well not to commence by making his own, but to use commercial plates until he understands something of their capabilities.

To return to our out-door operations. Let us suppose that the first subject taken is an open landscape, and that the artist has judged the right

exposure with a certain stop to be one second. He takes up the apparatus, and moves forward in search of pastures new. He now passes a wood by the side of the high road—a mass of greenery, relieved here and there by the trunks of silver birch trees. The camera is once more set up, and the foliage seems to fill up the entire picture. Now it is evident that such a subject will require far more exposure than the open view just taken, and it eventually receives three seconds. Again the camera is moved, until an opening in the hedge permits the wanderer to enter the wood itself. A beautiful glade of trees, with the branches almost meeting overhead, strikes his attention. The picture seems so dark on the ground-glass that, were it not for a few bright branches that meet the eye close at hand, it would be a very difficult subject to focus. The exposure can be prolonged to perhaps three minutes, or a good deal more; and yet, when the picture is afterwards developed, it may be found to be much under-exposed. As a rule, the beginner is far more likely to err on the side of over-exposure; and this is well, for an over-exposed plate can be turned into a decent negative; an under-exposed one is good for nothing.

CHAPTER IV.

PORTRAITURE.

Although the majority of amateurs will be content to produce landscapes, they will also have a natural wish to try their hands at portraiture. The difficulties of this branch of art are sufficiently attested by the very dreadful productions very often shown by amateurs as examples of their skill. Still, for all this, it is possible, if care and thought be given to the work, to produce a likeness and picture of a very pleasing character. Most amateurs, when they do try anything of the kind, are content to let their model stand or sit in the open air, taking advantage of any natural background that a garden wall or a hedge will afford. But, under such circumstances, the operator has no control over the light from the sky; and this light, beating upon the sitter's head, and being reflected strongly from the glistening hair, very often in the finished picture gives the appearance of premature baldness. This is avoided in some degree by using a fixed background, such as a screen covered with brown paper, with a roof of the same character projecting above the sitter's head. But, even with such an arrangement, the picture is seldom satisfactory, and suffers much from contrast with one taken by a professional photographer in a proper studio.

Moreover, the operator will not care for the trouble and inconvenience of a method so dependent upon fine weather.

Before the advent of gelatine plates, no one would have thought of attempting portraiture in an ordinary room, for the simple reason that want of light would have caused the exposure to be protracted to a prohibitive extent. But now, by the help of extremely rapid plates, this want of light is compensated for, and a picture can be taken indoors in from ten to twenty seconds.

One of the first requisites to ensure success is a suitable background. This need not be larger than five feet by four. This size will allow for a three-quarter length figure, and beyond this the operator should not attempt to go. Full-length figures require an amount of lighting from top to toe which is not attainable in ordinary rooms. A background for the purpose can be bought; but many will prefer to make their own, and this is by no means a difficult matter if the following directions be observed.

Make a rough frame of wood of the size required. The wood may measure 2½ inches by 1 inch, or thereabouts, and can easily be obtained at the sawmills. It need not be planed; for its office is only of a temporary nature—namely, to serve as a support to the material of which the background is made whilst being coated with colour. Its corners should be made, however, with lap-joints, so that the frame shows one flat surface. Upon its face is carefully tacked a piece of strong sheeting, the edges of which

are tightly pulled over the edge of the frame and tacked outside, just in the same manner as a painter's canvas is fastened to its support. When the material is firmly fixed, without showing any trace of a wrinkle, the colouring may be proceeded with.

To make the colour, take about two pounds of common whiting, break it into pieces in a large basin, and pour enough warm water upon it to cover it. Let this stand for ten minutes; then, with a spoon, stir it up until it forms a thick white cream, free from lumps. To this cream add in small quantities some drop-black, which has been previously rubbed down on a glass slab with a palette knife with some water. After every addition, well stir the mixture, so that the black is well diffused throughout its mass, until the whole assumes a pearly-grey tint. Like nearly all distemper colours, the tint is deceptive; for it will dry of a much lighter tone than it assumes when wet. But the real colour can easily be ascertained by smearing some of the compound upon a card and drying it.

When a satisfactory colour is arrived at, the mixture must have some size added to it to bind its particles together; otherwise it would rub off when dry. About two ounces of good size, dissolved in a breakfast-cup full of hot water, will be about the right quantity. Add this to the contents of the basin, stir well, and the paint is ready for use. With a good large brush paint over the stretched background, crossing and re-crossing the lines described by the brush, so as to insure a good surface. If the

brush works stiffly, add a little more size and water. The background can now be left until it is quite dry, after which it can be cut from the frame and rolled up on a roller. But, of course, it can, if preferred, be left as it is.

With regard to the relative positions of sitter, background, and camera, a great deal might be written; for these positions must vary very much with the shape of the room at the disposal of the photographer. If the model be placed too near a window, then the resulting portrait will consist of such strong contrasts of light and shadow as to look like so much chalk and soot. If, on the other hand, the sitter is far away from the window, the portrait must have an impossibly long exposure. In the annexed diagram (Fig. 10) the best positions are indicated for a room with one window—and, indeed, for a room with more than one window; for one only should be employed, the rest being darkened. In this diagram, W is the window, C the camera, B the background, S the sitter, and E a screen so placed that it will reflect light upon the shaded side of the figure.

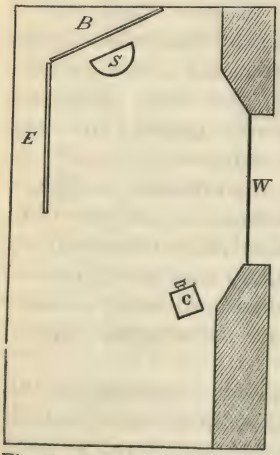

Fig. 10.—Arrangement of Necessaries for Portraiture.

This screen may consist of a clothes-horse covered with a white sheet, and should be as near the sitter as possible without encroaching upon the picture. A cheval glass is also a capital means of lighting up the dark side of the sitter. Should the window admit direct sunlight, the panes should be shielded with white tissue-paper, which will afford then a beautifully soft light. I can hardly trench upon the subject of posing. The amateur must be left to his own taste in this matter, and will do well to study the works of others, both painters and photographers. In photographing in a room, I have often found great advantage in using a candle flame as a guide to sharp focussing. If the light be very poor, and there is some difficulty in getting a sharp image, let the sitter hold a lighted candle in the same plane as his features. The operator can then focus the flame itself, and the picture will be all right in this respect.

Of course the portrait will be obtained with the shortest exposure by using a portrait lens; but this is not absolutely necessary. A cheap single lens will do the work, or an ordinary double-combination landscape lens can be used. It should in any case be of long focus, or the picture is liable to suffer from distortion.

CHAPTER V.

THE DARK ROOM AND ITS FITTINGS.

THE amateur photographer should, if possible, have a room to himself in which he can carry on his various operations without interruption. I know well that good pictures have been produced in hastily-improvised dark rooms, and if the amateur merely aims at the occasional development of a negative or two, such accommodation may answer his purpose. But for those who wish for higher flights, and would enter upon the work of plate-making, a room, or den, which the worker can call his own, is a *sine quâ non*. The room which I myself devote to this purpose also serves me occasionally as a carpenter's shop, and a place for more general work. By a simple arrangement, I can draw a red screen in front of the window, and the room is instantly ready for developing a a plate, or for other photographic purposes. The convenience of this plan must be experienced to be appreciated, and I cannot recommend it too strongly.

The screen is made thus—First of all construct for yourself, or have made for you, a flat frame of such a size that it will lap over each side of the window some few inches. If the window be large, the frame will require a cross piece in the centre to hold it firmly together, and this will in no way interfere

with its efficiency. Over this frame stretch a piece of the red fabric known as ruby medium, which is sold on purpose for photographic use. The edges of this fabric must be secured to the frame by tacks and glue. Now glue all over the red surface orange paper which has been stained with a coating of aurine dissolved in spirit. This paper ready prepared can also be purchased. The frame thus made admits plenty of light of such a quality that the quickest plates are safe during development. It would not, however, be safe to trust to daylight, although thus filtered, for plate-making. For that purpose the red lamp is far better.

Having constructed the frame, the right and left hand faces, where they will eventually touch the window frame, must be covered with two thicknesses of felt, so that no light can creep in there. Two grooves are now made out of pine, double the length of the frame. They are fixed above and below the window frame, and project beyond either to the left or right, whichever may be the most convenient. The frame slides between these grooves, so that when in use it is in front of the window, and when not wanted is slid away against the adjacent wall. In cases where space is wanting for this arrangement, the frame can be hinged at the top, and can have a fastening button below. A cord working over a ring in the ceiling can then be arranged to pull it out of the way when not wanted. The method can be modified in other ways, and the arrangement must be entirely governed by the construction of the room, and the position of the window therein.

If possible the dark room should have a sink with a tap above it. One can manage without it by using a bath and a water-can, but the labour of fetching to and fro is altogether saved if a sink and tap are at hand, to say nothing of the convenience which they afford in all sorts of other ways. The annexed diagram (Fig. 11) will show the general positions of the

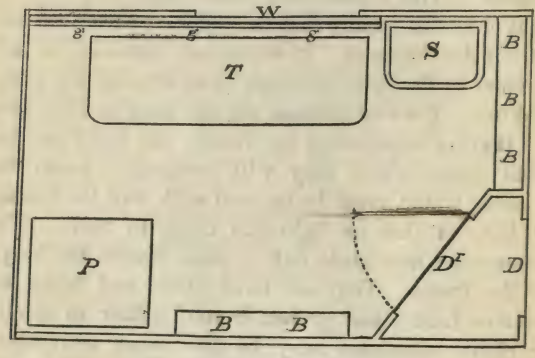

Fig. 11.—Plan of Dark Room.

various requirements of the room which I myself use, and it will serve as a guide to others.

W is the window, S the sink, T a large table, fitted with drawers for the temporary accommodation of sensitive plates, when making transparencies, and for various other articles; P is my photographic four-poster, described and figured elsewhere; B B are shelves one above the other for bottles containing chemicals, etc. Beneath the sink is a rack for dishes. D is the door proper of the room opening outwards:

D I is an inner door which I have added myself. The convenience of double doors will be apparent when such an operation as plate-making is going forward, for one can enter or leave the room without letting in any light from outside. Between the two doors there is just room enough to stand comfortably in the interval which elapses between the closing of one and the opening of the other. In the absence of such an arrangement a thick curtain must be placed over the one door, but it is not half so convenient, and it harbours that *bête noir* of the plate-maker—dust. I will now briefly describe the chemicals which will enable the photographer to commence work, so far as the making of negatives from purchased plates is concerned. I give in each case the quantity advisable to start with, and its approximate price.

Neutral oxalate of potash, 1 lb., price about 1s. 4d. I have mentioned elsewhere how this can be compounded at a cheaper rate. Otherwise boiling water must be saturated with the bought crystals, and bottled for use. This mixture keeps indefinitely.

Sulphate of iron, 1 lb., price about 3d. This is kept in special bottles, as directed elsewhere.

Pyrogallic acid, 1 ounce, price about 1s. 8d. This can be kept in its original bottle, or part of it may be be mixed as a stock solution (see directions for developing plates).

Liquid ammonia, 880°, ½ lb., price 6d. To be kept in screw-stoppered beer bottle, or mixed with an equal bulk of water and kept in ordinary bottle.

Bromide of potassium, ½ lb., price about 10d.

Hyposulphite of soda, 1 lb., 3d. This salt should be kept in a covered jar. In moist air it becomes deliquescent; therefore keep it dry.

Methylated spirit, 1 pint, 6d. Be careful to get the pure spirit. As sold at many of the shops it is mixed with gum for the use of French polishers; it is then called methylated finish. Some persons do not know the difference, and will innocently supply the one for the other.

Citric acid, in crystals, 2 ounces, price 6d.

Bicarbonate of soda, 2 ounces, 2d.

Alum, 1 lb., 2d. This can at once be put in a half-gallon bottle, and filled up with water. As the solution is used more water is put in, until the layer of alum at the bottom of the water is exhausted.

Bichloride of mercury, ½ ounce, 3d. This is such a very poisonous salt that it had better be at once mixed up with a like quantity of sal ammoniac, and 12 ounces of water. This forms one of the intensifiers recommended.

Chloride of gold, one 15-grain tube, price 2s. *See* directions for toning prints.

Acetate of soda, 4 ounces, 4d.

For plate-making there will be further wanted nitrate of silver and gelatine. The quantities of each must be governed by the operator's requirements.

Let every chemical be kept in a bottle. If laid about in packets, subject to the air and dust of the laboratory, they quickly become unfit for the delicate work they have to do. Stock solutions, which are

constantly in use, should be kept in bottles of different shapes, so that they are easily recognised by touch in the dim red light allowable.

The following articles should also find a place in the dark room :—Several dishes for development, etc., —ebonite are the best—a plate-draining rack, a pneumatic plate-holder, a retort stand, a pair of scales, with weights from 2 drachms to $\frac{1}{2}$ grain, one or two glass funnels, filter papers, cotton wool, two glass rods, plain glasses for making plates, some brown-ware covered jars to hold emulsion, two large pans of earthenware, an earthenware colander, a square of Berlin woolwork canvas, and negative varnish.

CHAPTER VI.

DEVELOPMENT OF THE LATENT IMAGE.

I REMEMBER once witnessing the performance of a melodrama, in which the discovery of the villain of the piece depended upon a photographic incident. A little black boy sat himself before the camera, and directed a friend to uncover the lens, and to run to a certain tree some hundred yards away before he returned to re-cap the instrument. The journey to the tree and back was to allow time for the necessary exposure. Whilst the operator was absent, a Red Indian crept in, to slow music, and tomahawked the boy, in order to steal some letters he was carrying. The operator then returns, and, seeing the boy killed, fancies that the camera has been the delinquent; so he proceeds to smash it to pieces. But, all of a sudden, the sensitive plate drops out, and the man recognises the portrait of the murderer, with his weapon uplifted above the boy's head. By this means the Red Indian is tracked and brought to justice.

Now, it is very certain that the ingenious contriver of this incident was not a photographer; or that, knowing better, he sacrificed truth to dramatic effect. As a matter of fact, the sensitive plate, when it is taken from the camera, looks exactly as it

did when it was first placed there. The change which has taken place on its surface is not visible; nor can it be made visible until the operation called "development" is proceeded with.

Development must take place in the dark room, either by the light of a ruby window or of a red lamp. In either case, if the plates be of a very rapid quality, they should be kept at first at a distance from the source of light; but, when the development has once begun, this precaution is not needed. Indeed, in the case of iron development, which will be described first, the solution used is itself of such a red colour that it forms its own protection to the plate—so that, once the plate below the surface, a naked candle flame could be used without much risk. This, however, is not to be recommended, as a ruby lamp will afford all the light requisite.

There are a great number of different methods by which the latent image received in the camera on a gelatine plate may be made to appear; but they can all be grouped under two heads—namely, iron development, or the ferrous-oxalate method; and alkaline development, in which pyrogallic acid and an alkali play the principal parts. Some advocate one method and some the other, and there has been many a controversy as to which is the best. Perhaps the most curious part of the matter is that, while English professional photographers are wedded almost without exception to the alkaline development of plates, their continental brethren are almost exclusively patrons of the ferrous-oxalate formula. The beginner will certainly find the

latter method the easier, and that therefore will be first described. He will afterwards find that certain makes of plate will take more kindly to the alkaline method; so that it is highly desirable that he should know the particulars of each. But let him guard against one mistake. Let all dishes and vessels used for the one method be perfectly cleaned before they be used for the other; for a mixture of the two makes a dirty compound akin to common writing-ink.

DEVELOPING WITH FERROUS-OXALATE.

In spite of what its detractors may say, this method of developing a plate has many advantages, not the least of which are its cleanliness—for it will not stain the fingers—and the possibility of using the same solution for a number of plates. Two standard solutions are required, which should be compounded some hours before they are wanted; for both are made with boiling water, and must be allowed to cool.

A	Neutral Oxalate of Potash	8 oz.
	Boiling water	1 pint.
B	Protosulphate of Iron	12 oz.
	Boiling water	1 pint.

These quantities in both cases will make saturated solutions; that is to say, the water will take up a certain quantity of the salt, and no more. If more were added, the excess would appear as crystals at the bottom of the containing vessel.

In the case of solution A, it will probably be found to turn rather milky. This is due to the formation of oxalate of lime, owing to the use of hard water. It

is of no consequence, for the slight precipitate sinks to the bottom of the vessel, and the clear portion can be bottled off for use. In mixing the crystals with the boiling water, the mixture should be stirred until they are thoroughly dissolved. This applies to both A and B. The first-named solution, A, requires no special care in the way of preservation; it will keep indefinitely in an ordinary bottle. But the other solution will quickly spoil if in contact with air; so it should be put up in small bottles, say of one ounce capacity, filled up to the cork, or else kept in bulk in a special form of receptacle. Here is a contrivance made out of a pickle-bottle, which I devised for the purpose. The cut (Fig. 12) almost explains itself. The bottle is fitted with a bung, in which are pierced two holes for the reception of glass tubes. One tube is short, and is crowned with a thistle-head, such as can be obtained at any philosophical instrument maker's. The other reaches to the bottom of the bottle, and is bent over at the top. The contrivance is used in this way: it is filled by the smaller tube three-parts full of iron solution, on the top of which is poured an ounce of castor oil. This, of course, floats on the top of the liquid, and seals it from the air. Upon blowing through the small tube—and the lips can be pressed against the thistle-top for the purpose—a

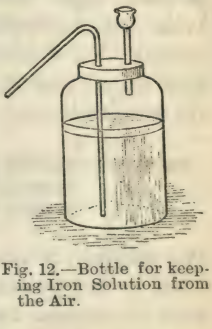

Fig. 12.—Bottle for keeping Iron Solution from the Air.

stream of liquid is forced through the bent delivery-tube. Iron solution can be kept by this means indefinitely; but, if kept in an ordinary bottle, it quickly becomes useless.

We will suppose that the beginner has prepared these stock solutions A and B, and also another consisting of

Bromide of Potassium	**20 gr.**
Water	**1 oz.**

He can now proceed to develop a plate.

In my own practice, when I am developing with ferrous-oxalate—which I often do—I place on my dark-room table four dishes in a row. The one on the extreme right contains pure water; its neighbour holds the developing mixture—to be presently described; No. 3 contains a saturated solution of common alum; and the extreme left-hand dish contains the fixing solution.

Developer—Solution A	**2 oz.**
Solution B	**½ oz.**
Bromide Solution	**4 drops.**

The solution B must be poured into A, and not *vice versa*, or a thick muddy mixture will be formed which must be thrown away and wasted. The developing solution, when mixed, should be of a rich red colour. If this is not the case, and if it should throw down a precipitate, too much boiling water has been used in the first operations. It is therefore far better to add several ounces too little than half an ounce too much;

for in the first case you will have your solutions saturated, and in the second you will not.

To make the fixing solution, mix the following :—

Hyposulphite of Soda	**2 oz.**
Warm water	**½ pint.**

The crystals can be placed in the left-hand dish, and the warm water poured upon them. They will soon dissolve, and the solution will quickly become cold. Everything is now ready for the development of a plate, and we will suppose that we have one which has just been taken from its slide after exposure in the camera. First of all, soak it in the right-hand dish of plain water. Many operators dispense with this ; but it has the advantage of making the developer afterwards flow easily over the surface, and I am convinced that, in the case of ferrous-oxalate development, it confers upon the plate increased density. After about half a minute's soaking, the plate is hastily drained by holding over the dish vertically, and is then placed in the developer (dish No. 2). Carefully see at this point that there are no bubbles sticking to the surface ; for, if allowed to remain, every one will afterwards be represented by a white, clear spot. Such bubbles can be readily removed by passing a flat camel-hair brush over the plate as it lies in the dish. We can now gradually watch the image creeping out, and a very wonderful sight it is too. First the strongly-marked lights appear—in a landscape the sky, in a portrait the face, or possibly some white portion of the dress, such as the collar or

cuffs. Next the half-tones appear, full of delicate detail; while the shadows remain almost white—the extreme shadows quite white. (We must bear in mind that we are producing a negative in which the lights and shadows are all reversed.) We need not be in a hurry to remove the plate until the details begin to disappear, and the picture seems almost on the point of being blotted out in a general darkness. Now take up the plate, wash it under a tap or with a jug of water, place it in the alum solution for a minute or two, and then examine it. Upon holding it up towards the red light—or it will do no harm to look at it by ordinary lamplight for a few seconds at this stage—it will be found that the glass is quite opaque. Upon examining the back of it, it will be noticed that the blackening of the image only shows in certain parts, and that the bulk of the sensitive film still remains white. It is to dissolve out this unused portion of the chemical surface that the plate is put into the fixing bath, previous to which operation, however, the alum solution must be entirely removed by copious washing.

It is as well to watch the gradual action of the soda solution in this last dish. First of all, the edges of the plate will become quite clear; then it will seem as if the film were gradually eaten away by the fixing solution until the action is complete. It is as well to let the plate remain in the fixing solution for some minutes after every trace of white has disappeared from the glass. The negative—for such it now is—is then well washed under the tap, and placed

in a deep dish of water for some time, say two hours. At the end of this period it may have another good rinse, and can then be placed in a rack (Fig. 13) to dry.

Among the objections which have been urged against ferrous-oxalate development is the one of expense. But this plea can certainly not be maintained, for the same developer may be used over and over again. The quantity at first mixed, say $2\frac{1}{2}$ ounces, will develop a dozen 5×4 plates at least, one after the other, gradually getting slower and slower in its action. But it need not be thrown away, for it can easily be renovated for another occasion. Put it into a *white* glass bottle, add to it a few drops of a solution of tartaric acid (acid, 20 grains; distilled water, 1 ounce), expose to light—sunlight, if possible—for a few hours, and it is ready for work once more. In the country last year I developed 150 negatives with one half pint of iron solution which I took with me, and renovated as described from day to day.

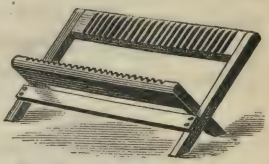

Fig. 13.—Plate-draining Rack.

In case the amateur should be in some place where neutral oxalate of potash is not readily obtainable, he can easily make it for himself, thus :—

Carbonate of Potash (salts of tartar) ...	**1 lb.**
Oxalic Acid	**12 oz.**
Warm water	**3 pints.**

In a large basin place the potash and pour upon it the

water; stir until dissolved. Now gradually add the crystals of oxalic acid a little at a time, or the effervescence will cause the mixture to bubble over. Shake the crystals in until the whole are added. In an hour or two the compound is ready for use, and can take the place of solution A in the developer. The solution thus formed is most reliable, and is a good deal cheaper to make than if oxalate of potash be bought ready crystallised.

ALKALINE DEVELOPMENT.

Of the various published formulæ for alkaline development, the most simple, and therefore the one which the beginner should first try, is the following, which will be found to suit all the commercial plates at present in the market. It has the great advantage of requiring only one stock solution, a few drops of which only are required to develop each plate. To an amateur, therefore, who wishes to have the means of developing a plate on his travels abroad, this plan is invaluable, for he need only encumber himself with this one liquid. The other chemicals required being in a dry state.

STOCK SOLUTION.

Bromide of Potassium	**2 dr.**
Water	**4 oz.**
Liq. Ammonia, *fort.*	**2 oz.**

The plate is first allowed to soak in water in the developing dish for half a minute. While it is soaking, add five drops of the above solution to two ounces of water in a glass measure. Pour off the water from

the plate, and immediately let the ammonia solution take its place. While this is upon the plate, put into the glass measure three grains of pyrogallic acid. A bone spoon can conveniently be employed for this purpose. Empty the contents of the dish upon the dry pyro, which will immediately dissolve, and then return the mixture to the plate. If the exposure has been properly timed, the image will begin to appear in about one minute, and will gradually gain strength. When all the details are visible, and the development seems to hang fire, drop three or four more minims of the ammonia solution into the cup, turn the developer into it, and again restore it to the plate. This fresh accession of ammonia will immediately take effect in darkening the image, and in half a minute, or a trifle more, the operation will be complete. Now pour off the developer into the sink, and wash well under a good stream of water from the tap, taking good care that every trace of developer is washed away. Now put the plate in the alum dish, and in due course transfer it to the fixing solution.

In developing by the alkaline method the darkening of the film should on no account be allowed to go so far as in the case of ferrous-oxalate development, and for this reason : the colour of the pyro-developed negative is of a yellowish tinge, and, therefore, more non-actinic than a negative developed with ferrous-oxalate. In the after operation of printing, a pyro negative, which appears thin when compared with one developed with iron, will possibly give a far

more vigorous print than the latter, simply on account of the difference of colour between the two. The weighing out of small quantities of dry pyrogallic acid every time some plates have to be developed would be out of the question; and this method of using it dry would not be recommended were it not for the circumstance that when weighed out once or twice the right quantity can be easily guessed at. The exact quantity here recommended is not, moreover, at all essential to success, for a wide margin can be allowed. Let it be remembered that the pyro gives density, that the ammonia acts as an accelerator, and that the bromide is a restrainer. A bottle of bromide of potassium (twenty grains to one ounce of water) should be at hand to check development, when the image flashes out rapidly, and thus indicates over-exposure. In this case at once pour off the developer, and flood the plate with the bromide solution. Development can then recommence, using a fresh mixture containing double the quantity of pyro, and half the quantity of ammonia solution. Where the first plate of a batch indicates over-exposure, and there is a reasonable presumption that the rest suffer from the same complaint, the error can be remedied thus:—Instead of placing the plates in plain water before development, let them soak for a minute in a solution of bromide of potassium (three grains to the ounce of water). This plan seems to exert a greater check upon the plates than if the bromide were merely added to the developer.

Mr. G. W. Webster was the first to suggest the

use of a soluble citrate in the developer to check over-exposure, and he claims that its use will actually save a plate which has received two or three times the exposure which it should have done. Citrate of soda is found to give the best results, and the strength of the solution recommended is ten per cent. (*i.e.*, one ounce of citrate of soda to ten ounces of water). A bottle of this should be kept at hand in the developing room. If a plate gives evidence of over-exposure by flashing out under the developing fluid instead of appearing in a gradual manner, a drachm or two of the citrate solution is added without loss of time, and the plate will be rescued.

When the operator is at home, surrounded, let us hope, with better conveniences for work than when he is on the tramp, he will doubtless prefer keeping the pyro as a stock solution ready for work. Pyro in water will only remain good for a few hours, but there are many means for preserving it. Here is a stock solution, which will remain good at least for some weeks :—

Citric Acid	... ...	**2 dr.**
Water	... ...	**5 oz.**
	(dissolve and add)—	
Pyrogallic Acid	... ...	**160 gr.**

One drachm of this solution will contain just four grains of pyro, and this quantity added to, say three ounces of water, will develop a plate. I need hardly say that the ammonia and bromide solution must be added as well.

The strong liquid ammonia used in photography

is unfortunately not a stable compound; it is constantly giving off gas, and is weakened every time the stopper of the bottle is removed. A warm room, or even the warmth of the hand, is sufficient sometimes to blow the stopper out of the bottle. For this reason it is well to mix it at once with an equal bulk of water. I keep my ammonia (and various other chemicals of a fugitive nature) in bottles having screw tops made of vulcanite, round which is a band of indiarubber. These bottles have lately been introduced for beer. They are very strong, and can be had in pints and half pints. I look upon them as a very great boon for use in the laboratory.

Although ammonia is far more widely used than any other alkali for development of gelatine plates, it is by no means the only one which can be put to that purpose. Many use common washing soda, and I can certainly testify to the beautiful negatives which can be obtained with it. It has the merits of being a fixed alkali, it gives off no fumes, and is at hand in every household. The following is a good method of employing it.

Into a quart bottle put a quarter of a pound of washing soda, and fill up with warm water, add to this twelve grains of bromide of potassium. This mixture will keep good for any length of time, and can be regarded therefore as a stock solution. When required for use, put into the developing cup one grain of dry pyro for every ounce of solution required, the quantity to be measured by the size of the picture to be developed, and pour upon it the soda solution.

This last developer has a sweet simplicity about it, and works well. Here is another formula, in which the pyro figures as a stock solution, and keeps perfectly well indefinitely—

A	Oxalic Acid	96 gr.
	Pyrogallic Acid	64 gr.
	Bromide of Ammonium	32 gr.
	Water	1 quart.
B	Washing Soda	4 oz.
	Water	1 quart.

Mix equal quantities of each immediately before use. In using either of these soda developers it is as well to have at hand the means of accelerating their action in case of under-exposure. A saturated solution of soda will accomplish this, a few drachms being added to the contents of the developing cup, if the image seems to be unusually slow in gaining the requisite density. If, on the other hand, the picture flashes out too quickly, the bromide solution should be ready to check the action in the manner already indicated.

Here is another simple developer, which is a favourite, but for some hidden reason it does not answer with all varieties of plates.

Citric Acid	15 gr.
Bromide of Potassium	60 gr.
Sulphite of Soda	120 gr.
Liquid Ammonia	3 dr.
Rain, or distilled water	1 quart.

In use add one grain of pyro to each ounce of solution.

Dr. Eder, a well-known scientific photographer,

recommends the use of the alkali potash in the developer, to take the place of the ammonia or soda, cited in the usual formulæ. He claims for this substitute several advantages, among which are the stable nature of the alkali, the possibility of making with it a concentrated solution which is small in bulk; its capability of prolonged action on the film without stain or fog, and the brilliancy which it will give to a negative. Here is his recipe—

A	Pure Carbonate of Potash	90 parts.
	Water	200 ,,
B	Pyrogallic Acid	12 ,,
	Sulphite of Soda	25 ,,
	Citric Acid	1½ ,,
	Water	100 ,,

Before use mix with three ounces of water forty to sixty drops of A, and the same quantity of B. This will give a vigorous image; but if finer and softer results are required, a larger quantity of water must be used.

In compounding these developers, the utmost cleanliness must be observed, with regard not only to containing vessels, but also to the scale pans in which the chemicals are weighed. These should be of glass, and should be carefully wiped out with a piece of clean tissue paper before use. Liquids must be measured in the graduated glasses sold for the purpose, it being understood in all formulæ that ounces of liquids mean ounces by measure, and not actual weight.

It will be found that sometimes after development and fixation a plate shows some stains, which it is

highly desirable to get rid of as speedily as possible. This can be done by leaving the plate, after it has been fixed and well rinsed under the tap, in the following solution for two or three minutes.

Alum	2 oz.
Citric Acid	1 oz.
Water	10 oz.

This solution will keep well, and can be used over and over again. Its action is almost instantaneous. It is only required after alkaline development. Ferrous-oxalate development leaves in its wake a slight milkiness in those parts of the negative which should look like plain glass. This is due to oxalate of lime, formed in the film by the use of hard water. It is of no consequence, and usually disappears when the plate is varnished.

I have already hinted at the necessity for prolonged washing of the plate, after removal from the fixing solution. Unless the hyposulphite of soda be completely eliminated, the negative will most surely fade. Anyone who cares to try the truth of this statement can do so very easily by a simple experiment. Take a negative—a faulty one will do—and after removal from the fixing bath, and rinsing it under the tap, place it in a vessel of water, so that only the lower half is immersed, for about two hours. It will be found, at the end of this time, that the upper part of the negative has faded down to about half its previous tone. When I have occasion to develop a batch of plates away from home, I place them, after fixing and rinsing, in a pailful of water,

the film side towards the sides of the pail. The plates standing on their edges in this manner are soon thoroughly washed, but they should each have a final rinse under the tap before being allowed to dry.

A design for a very simple washing frame for negatives appeared lately in the *British Journal of Photography*. It is easily made, with a few strips of zinc, by any one who knows how to handle a soldering iron. Its great merit is that it can be lifted bodily out of a bath of water, and replaced when the water has been changed. The annexed figure explains itself.

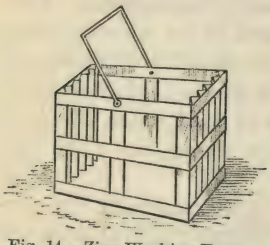

Fig. 14.—Zinc Washing Frame.

Before leaving the subject of development, a few difficulties which are likely to occur to the beginner may be briefly alluded to. In the first place, different makers' plates behave quite differently, even if treated with precisely the same developer. It requires a certain amount of experience to determine which developer is most suitable with a given make of plate. Another difficulty is found in judging the precise amount of density which the plate has attained under development, and calculating therefrom whether the operation is complete, or whether the action should be allowed to go further. This last difficulty is caused principally by the small amount of light permitted in the dark room. But it must be remembered that

after the image has once made its appearance, the amount of light can be greatly increased without any danger of spoiling the plate. It would be a good plan in the dark room to have part of the window or lamp protected with yellow glass only. This could remain covered with an opaque screen under ordinary circumstances, but could be uncovered just at that moment when the development seems complete. By holding up the picture to such a light, the real density obtained could be far better gauged, than it can be under ordinary circumstances. It is well known that clever photographers are often deceived in this matter of judging density, and will under- or over-develop a plate now and again in spite of all their experience.

Remedies for both these faults will form the subject matter of the next chapter.

CHAPTER VII.

INTENSIFICATION AND REDUCTION OF NEGATIVES.

From what has been already written, it will be evident that a plate, even a properly exposed plate, may, in its subsequent journey through the dark room, become either too thin to give a perfect picture in the printing frame, or so dense that the operation of printing is enormously prolonged, the light in this case not being able to get through the darkened and discoloured negative. Luckily a remedy can be found for both these contingencies; but let it be remembered that prevention is better than cure, and that a negative which needs no doctoring is, compared to a faulty one, as a healthy man is to an invalid. A thin film, caused either by under-development or over-exposure, can be endowed with extra density by the process known as Intensification.

Before this process is attempted, the negative must not only be very thoroughly washed, but the last trace of the fixing solution, which seems to stick to the gelatine like a limpet to a rock, must be removed. For this purpose various solutions have been recommended. Captain Abney advises the use of peroxide of hydrogen. This compound can be easily obtained, for it is extensively used as a hair restorer, giving that gold colour to the hair which was so fashionable

not many years ago. As sold, the peroxide is too strong for photographic use; it should be diluted with forty times its bulk of water. When the plate has remained in this mixture for about fifteen minutes, and has been well washed, the intensification can proceed. The first method which I recommend is the mercurial intensifier. I am aware that many persons object to this because it has the character of not being permanent. I can only say, in answer to this, that I have some negatives in my possession which were treated in the way about to be described, and they are as perfect as when they were operated upon about three years ago. Soak the negative in the following solution:—

Bichloride of Mercury	**½ oz.**
Sal Ammoniac	**½ oz.**
Water	**12 oz.**

If it should only require a moderate amount of additional density, let the negative remain in the solution until the film acquires a uniform grey tint. The action can be hastened by rocking the dish. But if the negative is very thin, but still possesses plenty of detail, it may remain until the image is bleached perfectly white. Now wash the picture most thoroughly under the tap, and transfer it to a bath made thus—

Liquid Ammonia	**2 drachms.**
Water	**6 oz.**

The effect of this solution is almost instantaneous. The film becomes blackened, and merely requires an after-rinse under the tap before it is ready for drying

and varnishing. The mercury solution can be put away for future use, and can be employed again and again until exhausted. Keep it in a safe place under lock and key, and use it with caution, for the mercurial salt employed is the active poison known as *corrosive sublimate.*

Another plan for discharging the last traces of hyposulphite of soda from the film previous to intensification is a prolonged soaking in a strong solution of alum; but if time will not admit of this, the same end can be attained by using *Eau de javelle.* This is made as follows, but must be diluted before use with twenty times its bulk of water :—

EAU DE JAVELLE.

Chloride of Lime (dry)	**2 oz.**
Carbonate of Potash	**4 oz.**
Water	**1 quart.**

Mix the potash in ten ounces of the water, the lime in the remainder; mix, boil, and filter.

Mr. B. J. Edwards has published a very useful modification of the citric acid and alum clearing solution already described, by which pyro-developed plates are much improved in colour. The plate to be treated is taken out of the fixing bath and slightly rinsed, for to gain the desired effect some of the fixing salt must be retained by the film. The following mixture is then applied to it :—

Alum	**1 oz.**
Citric Acid	**1 oz.**
Sulphate of Iron	**3 oz.**
Water	**1 pint.**

The colour of the negative soon changes to a warm black. Perhaps a more convenient way for compounding the mixture would be to take, say, four ounces of the clearing solution before recommended, and to add to it just before use one ounce of saturated solution of iron, which employers of the ferrous-oxalate system of development will already have in stock. The same mixture can be used as an intensifier, by the addition of a few drops of a solution of nitrate of silver:—

Silver Nitrate	**20 gr.**
Distilled Water...	**1 oz.**

This is poured over the negative repeatedly until sufficient density is gained. But it must be remembered that, where intensification is intended, the negative must be thoroughly washed and treated with the plain clearing solution before the silver mixture is applied. After intensifying with silver, again soak in the fixing bath, and thoroughly wash as usual.

One more method of intensification I will describe, with a reminder that all these methods of improving thin negatives are only to be resorted to in case of need, and that a really satisfactory negative will require no such help.

A	**Gallic Acid**	**1 drachm.**
	Alcohol	**10 ,,**
B	**Silver Nitrate**	**1 ,,**
	Distilled Water	**16 ,,**
	Acetic Acid	**20 drops.**

For use, mix one part of A with four parts of distilled

water; then add a few drops of B, and apply to the plate.

Intensification is needed when a plate has been over-exposed, and when the fault has not been corrected by careful development. This is an accident which can easily occur; so it is as well to have a remedy at hand. Such a negative will be full of detail, but so thin and devoid of contrast that it will never yield a good print. We have now to consider the opposite case of a negative being so dense that its details are completely masked in its own substance. Such a case is the result of over-development, and is a common fault with those who do not allow themselves sufficient light in the dark room. Mr. Spiller recommends the following cure: Make up two stock solutions,

A—Alum	**4 oz.**
Copper Sulphate (blue stone)	**4 oz.**
Common salt	**8 oz.**
Water	**1 quart.**
B—A saturated solution of common salt, filtered.	

Mix these two solutions in equal parts, and immerse the negative therein. In very bad cases, use a larger proportion of the copper solution. When the required amount of reduction has taken place, wash, with B used alone, soak in water, and dry.

A few words about drying negatives will not be out of place. If the glasses are put in the draining rack in the open air, especially in sunshine, they will dry in an hour or two. If required in a great hurry, they can be placed in a dish of methylated

spirit for ten minutes. This will drive the water from the films, and cause them to dry very quickly. A pyro-developed negative can be blotted on clean blotting-paper, so as to remove the surface moisture, and can then be put in front of a fire to dry. The pyro exerts a tanning action on the gelatine, which prevents it melting in such a position. But the same treatment would utterly ruin a ferrous-oxalate-developed plate.

CHAPTER VIII.

VARNISHING THE NEGATIVE.

THE negative cannot be said to be entirely complete until it is varnished; and this operation should by no means be neglected if the negative is to be printed from upon silver paper, for the paper is apt to give up some of its silver to the gelatine surface and to cover it with red spots. Varnish is, too, a great protection against damp, to which a gelatine film is peculiarly liable. The operation may be omitted when the object of a negative is merely to yield a lantern-slide or transparency, and when its preservation after having fulfilled that purpose is a matter of indifference. In all other cases, the film must for its protection be covered with a layer of varnish.

The beginner may, perhaps, fancy that a brush dipped in any kind of varnish and painted over the negative will do all that is required; but here he is mistaken, for the work requires as much care as any other photographic operation. It is strange that a great many amateurs who can take good negatives fail in this final operation, which, after all, is simplicity itself. I feel certain that, if the following directions are closely followed, the reader will not add to the number of those who so commonly fail.

First of all, place the dry negative on a pneumatic holder, and warm it gently before the fire; but

by no means make it hot. Then pour a pool of varnish in its centre, as shown in Fig. 15; and it can during this operation remain on its holder, if desired. By gently inclining the plate the pool can be made to flow to each corner in succession,

Fig. 15.

and the surplus is emptied away *into another bottle*, as shown in Fig. 16. (Every precaution must be taken to avoid dust. The negative should be gently rubbed with a silk handkerchief before the varnish is applied, and even then some tiny particles may rest upon it; hence the use of the second bottle, so that the contents of the first may not be contaminated. Each speck of dust makes a little comet-like mark on the varnished film.) As the plate is held vertically over the bottle, as shown in Fig. 16, gently rock it from side to side,

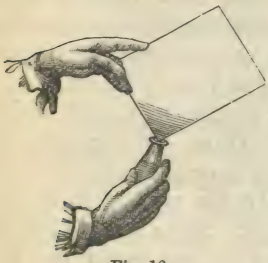

Fig. 16.

so that the fluid, now rapidly setting, may not form straight lines in direction of the dip of the plate. When the plate has almost ceased to drip, hold it before a bright fire for about two minutes, making it quite hot, and it is finished. It is as well to have the plate-rack near at hand, into which each plate can be dropped as

it is done. For extra protection, some persons recommend a preliminary coating of plain collodion, which is applied in exactly the same way as the varnish, only the warming and heating are omitted. When the collodion is thoroughly dry, the varnish is flowed above it and treated as just described.

Dry plate varnish, answering every requirement, can be purchased ready-made. It is sometimes rather too thick for convenient use, in which case it can be diluted with methylated spirit. My own practice is to buy from a reliable shop some best white hard varnish, such as is used for wood-work, and to fill it up with double its quantity of methylated spirit. This makes a capital photographic varnish, but it requires careful filtering before use. Then, by using two bottles, as already recommended, and filtering once more when the first one becomes empty, the compound is always in order and ready for use.

There is a little knack in filtering varnish which it is as well to know of. If an ordinary glass or porcelain filter be used, there is some after-trouble in thoroughly cleansing it. By the method to be explained this trouble is avoided. Make a paper funnel of writing-paper, such as a grocer would use for wrapping up an ounce of tea, gum it up, so that it will not come undone, and cut off the point, so as to leave an orifice large enough to admit a pencil. Into this hole push from the inside a tuft of cotton wool, and pull it through the opening to such an extent that it is firmly held there. Now prop this extemporised filter above a clean dry bottle, and pour in the varnish above. It will filter out bright and clear and quite

free from impurities. (A few drops of spirit may advantageously be poured into the filter in the first instance to moisten the wool.) The paper funnel, when once used, can be cast aside, and a new one employed on the next occasion, thus doing the work efficiently with very little trouble.

The diluted white hard varnish I consider as a good protection to the film under all ordinary conditions. Moreover, it can easily be made to take the pencil, for re-touching, if rubbed with a little powdered resin or pumice with the end of the finger. For those who prefer to make a special varnish, here is a good recipe :—

Orange Shellac	**2 oz.**
Gum Juniper	**1½ oz.**
Camphor	**½ oz.**
Methylated Spirit	**1 pint.**

Mix these ingredients together, when they will, with occasional shaking, dissolve in the spirit. If the bottle be placed in a warm situation, the gums will dissolve much sooner than they otherwise would. Filter before use.

Negatives are best kept stored in grooved plate-boxes; or they may, with a layer of tissue-paper between each, be wrapped in packets. Even if thoroughly protected with varnish, they should be kept in a dry room.

In case it should be found desirable to intensify a negative after it has been varnished, the varnish can be easily removed by warming the plate and pouring upon it some methylated spirit. Let this remain for a minute or two, and gently rub the surface with a tuft of cotton-wool. Repeat this process until every trace of varnish has been removed. Then proceed to intensify, and, when the plate is dry, re-varnish.

CHAPTER IX.

PRINTING FROM THE NEGATIVE.

THE operation of printing positives on paper, that is to say, the production of finished photographs for subsequent mounting in an album or for framing, is one that had better be postponed until several negatives are complete. For the operations required, consisting as they do of several distinct processes, can be more economically carried out wholesale than if we had only half-a-dozen prints to produce. Indeed, it would be quite out of the question to undertake the work for so few.

The printing operations may be divided into three distinct processes, namely, exposure to light under the negative, toning the prints, and fixing them. These must be considered in detail. We are taking it for granted that the amateur will buy his paper ready sensitised, as paper prepared at home will not, as a rule, keep good more than a few days, while that bought of reliable dealers will, if kept between the leaves of a book made of white blotting-paper, prepared by soaking in a solution of carbonate of soda, and drying, will remain good for weeks. The sheet of paper when bought measures about 22 by 18 inches, and must be cut into pieces the same size as the negatives to be printed from. It is possible to obtain as many as

forty-two pictures, *carte-de-visite* size, from one sheet of paper, if the cutting be performed to the best advantage. The careful operator will measure the sheet and plan out the best way of cutting it to the sizes required without waste. This should be done in a subdued light, but not necessarily in the dark room, for the chloride of silver to which the paper owes its sensitiveness is far less rapid than the chemicals with which we have hitherto been dealing. The greatest care must be taken not to touch the surface with damp hands, and in any case to handle it as little as possible.

The most convenient form of printing frame (see Fig. 17) is that in which the negative exactly fits the space provided for it; but should the pictures be smaller than the frames, a sheet of clear glass must be inserted upon which the negative, varnished size uppermost, must be laid. Then take a piece of the sensitised paper and lay it upon the negative, smooth side downwards, and on the top of this put a few sheets of clean dry blotting-paper. The cloth-faced back is then inserted, the springs adjusted, and the frame is ready for exposure to daylight. As a rule negatives must be kept away from actual sunshine during exposure. If they are very thin through over-exposure in the camera, they must be printed in a weak light. If, on the other hand, they be unusually dense, so

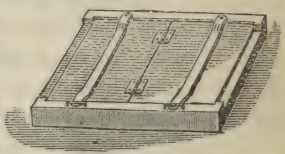

Fig. 17.—Printing Frame.

that the light has some difficulty in penetrating them, actual sunshine will do no harm. The hinged back will allow us to examine one half of the picture at a time, without separating the rest from the negative, and the printing operation must be carried on until it is a good deal darker than we wish it to appear when finished. The reason for this over-exposure is, that the subsequent processes of toning and fixing rob the print of a great deal of its original force.

As the pictures are printed they are removed from the negatives and placed away in a dark box, or drawer, until the whole batch is complete. On a fine day, and the operation should not be begun unless it is fine, a great many prints can be turned out in a few hours, and the printer will find very little time to waste if he carefully attends to the work of examination. For this work daylight is a *sine qua non*, but the subsequent operations can be conducted by lamplight.

The prints being all ready, we can proceed to tone them at once, or reserve them for a day or two. First, they must be put one by one in a large earthenware pan of clean water. This water will become milky, owing to the presence of the free nitrate of silver in the paper. At the end of fifteen minutes, they must be removed one by one to another pan of water, and again to a third at the end of a similar period. They are now ready for the toning bath. The need for some process by which the pictures can be made of a more agreeable colour will be apparent. When the prints are removed from the frame they are of a

dark sienna red, and after being soaked in water to remove the free silver, this tint changes to a still more unpleasant brick-red colour.

The toning bath which I recommend, is made thus—

Chloride of Gold	**1 tube (15 grs.)**
Acetate of Soda	**1½ oz.**
Water	**2 quarts.**

The gold is sold in glass tubes, which require to be broken before the contents are available. This is easily done by nicking the centre of the glass with a file, when it can be snapped in two over a sheet of clean paper. Put the contents, together with the soda, into a half-gallon stone jar, and fill up with distilled water. The contents of the jar may be shaken once or twice to help in dissolving the crystals. This bath should not be used until at least two days after mixing, and a better result is obtained if it be kept for a week first. The object of preserving this solution in a stoneware jar is to keep it, when not in use, in absolute darkness, for light slowly but surely decomposes it.

The beginner will, probably, as most beginners do, try several formulæ for toning before he attaches himself to one in particular; and for this reason, as well as for the sake of economy, it will be well to make the dry chloride of gold into a stock solution, which can be used as required. If, therefore, the little glass tube in which the salt is contained is broken into a bottle into which 15 drachms of distilled water have been previously put, we have at once a convenient way of

measuring out the precious salt. Each drachm of the solution will represent one grain of chloride of gold. The toning formula, already given, can, of course, be made up in any quantity, and during the time that the tyro is, as it were, feeling his way, it will be well to make up but one-eighth of the amount named.

Here is another recipe, which is fit for immediate use, after mixing, and must be used soon, for it quickly spoils—

Gold Solution	**1 drachm.**
Carbonate of Soda	**10 grains.**
Distilled Water	**10 oz.**

The following toning solution is much recommended for ready-prepared paper, to which it imparts a rich deep colour—

Hot Water	**15 oz.**
Borax	**90 grains.**

Stir the borax into the water and wait until the solution is cold. Then add one drachm of gold solution. In cold weather this bath may be warmed before use. I will give one more formula for a toning bath, which has a great many admirers—

Gold Solution	**2 drachms.**
Boiling Water	**15 oz.**
Lime Solution	**2 drops.**

The lime solution here mentioned is made by mixing one ounce of chlorinetted lime (*i.e.*, the common chloride of lime of the oil-shops) with half a pint of

water. This mixture is well shaken up in a bottle, and afterwards allowed to settle. The clear portion is afterwards decanted off for use. In making this toning bath, put the gold solution in a jug, with a small piece of chalk, then add the boiling water, and lastly the lime—taking care that this latter does not in the least exceed in quantity the prescribed allowance, otherwise the prints will be bleached instead of toned.

In using any of these baths the beginner will do well to make a few trial pictures, and these kept as specimens will do more to make him a good printer and toner than many pages of written instructions. Take a well-printed photograph direct from the printing frame, and cut it into four quarters. Wash them, as already directed, and then put them into the toning bath selected. Let one remain in until a certain colour is obtained, and the others for varying periods, marking with a pencil, on the back of each, the time of immersion, and the resulting colour. The four pieces can afterwards be fixed, washed, and dried, and then the operator will be able to judge which is the tone he likes best and which it will be his aim to reproduce on future occasions. He will find that prints which come out of the toning bath, looking bright and vigorous, will often after being fixed looked flat and weak, whilst those which look hopelessly dark and over-exposed, turn out, when finished, to be capital prints full of vigour and brightness. He will also find that some of the toning formulæ given will give better results if the picture is

not printed too deeply, and this is notably the case with the borax bath.

Some samples of ready-sensitised paper are rendered much more amenable to the action of the toning-bath by immersing them in a weak solution of common washing soda in water, after the free nitrate of silver has been washed away.

It is a great disappointment to the printer if, after spending much time and trouble upon a batch of pictures, he finds that several of them are marked, especially at the corners, with insensitive spots, which have refused to tone at all, and which preserve the brick-red colour common to untoned prints. These blemishes are due to impure fingers. Let the careful operator make it a rule not to tone when he has been messing with other chemicals. Let him constantly rinse his hands before touching the prints, and be most careful to use one particular dish for toning, and for nothing else. A good dish for the purpose is one made of *papier-maché*, of such a size that several prints can be put in it side by side at a time. I say side by side, for prints, while being toned, should on no account be allowed to lap one over the other. This is a fruitful source of irregular toning. The prints, too, should be kept in movement. They may be made to change places by sliding one over the other, and occasionally the tray or dish in which they are placed can be rocked so as to send the solution in a wave from end to end. If these precautions be carefully attended to, the operation of toning prints, in which so many

beginners fail, is sure to succeed. The operator should have near him, whilst he is toning, a large pan of clean water. As each print is toned it should be removed to this water, and kept there until all the pictures are ready for the next and final stage. The blank space caused by the removal of one picture can be immediately filled up by a fresh one, and the contrast between the red untoned paper, and that which has been under operation for some minutes in the toning bath, is a great help to the worker in judging of the depth of colour obtained. When in doubt as to whether a print is fully toned, it can be held up to the light. Should any red remain in the print, it can be well seen when the semi-transparent paper is looked through, in which case the print must be returned to the toning bath.

It will probably be found somewhat difficult to judge of the colour of prints by the red light of the dark room, so that it is advisable to conduct the toning operations by weak daylight.

It should be remembered, however, that the paper is still more or less sensitive to light until it has passed through the fixing bath.

CHAPTER X.

FIXING AND WASHING THE PRINTS.

In fixing prints, that is to say, in dissolving out those portions of the silver compound which have not been utilised in making the picture, the same salt is used which is employed to fix the negative on glass. Hyposulphite of soda, which was first put to this use by the famous astronomer, Sir J. Herschell, is at once the photographer's friend if it be used in its right place, and his deadly enemy if a small portion of it only should find itself where not required. For this reason, be careful that all the paraphernalia connected with the previous work of toning is jealously put away before the hypo comes upon the scene.

Hyposulphite of Soda	**½ lb.**
Warm Water	**1 quart.**
Liq. Ammonia	**1 dr.**

I recommend warm water to be used, because the solution of the soda crystals is hastened, and also because their liquefaction causes the water to be so chilled, that in a few minutes it is reduced to the temperature of the air. If cold water be used to begin with, the temperature falls many degrees, and it is always as well in using different solutions that they should be at equal temperatures. The ammonia

is added to correct any acidity which may be present.

When the soda crystals are thoroughly dissolved, the prints are taken one by one and immersed in the solution. A deep dish should be used for this purpose, and the prints should be kept moving as much as possible so as to allow the soda to act equally upon each. When all the prints are in the dish, the bottom one can be easily removed, and put on the top, then the next one the same, and so on until all have changed places. After fifteen minutes of this treatment the pictures will be fixed.

Unfortunately, it is far more easy to give the pictures their quantum of hypo than it is to remove the hypo after its work is done; and unless every trace of it is removed the pictures will most surely fade. To wash the prints by hand is the most effectual method, if it be properly done, but it is certainly tedious work. As the beginner will probably have only two or three dozen to wash at a time, he may adopt the following simple plan. Employ two large round earthenware pans, such as are used in dairies. Fill one of these with water. Take each print out of the fixing bath, and put it direct into this pan. When all the prints are thus transferred allow them to soak for five minutes, then carefully pour off the water, leaving the prints at the bottom. Fill up again, leave ten minutes, then take each print separately, and remove to the other pan, also filled with water. The two pans can now be employed alternately thus:—No. 1, we will say, is full with the prints floating

in it. Let them soak for half-an-hour. Empty away the water, so that the prints form a mass at the bottom of the pan. Prop up the pan on its side, so as to drain away the last drop. Now fill up once more, and, after another half-hour, transfer the prints to No. 2 pan. Go through the same procedure again, and in a few hours the prints will have been thoroughly freed from hypo. The business, no doubt, seems to the reader to be tedious enough, but other work can be going on at the same time. One friend I have who combines gardening with the art of photography, and whilst he is attending to his flowers, two pans of photographs are frequently to be seen in the corner close to a drainage grating, and he attends also to these at short intervals.

Many ingenious contrivances have been introduced for the washing of prints, and small apparatus for the use of amateurs can be purchased, but most of them rely upon the system of constant change of water and occasional drainage, which method I trust I have made clear in my directions for washing by hand. The last mechanical washing apparatus that has been introduced (Fig. 18) I have seen in action, and it certainly seems to do its work remarkably well. It consists of an outer case of wood lined throughout with zinc. In this cistern, supported above the bottom, is a perforated cylindrical vessel to hold the prints. This as well as the cistern is kept full of water by the supply-pipe on the left-hand side, but the water is delivered in a particular

manner, to which the apparatus owes much of its efficiency. Two brass pipes, which will be noticed crossing the back of the box, are perforated with

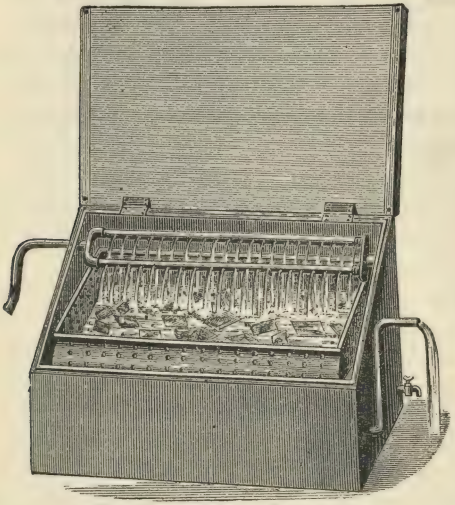

Fig. 18.—Photographic Print Washer.

numerous holes in such a manner, that the streams of water issuing from them strike the body of water below in such a direction as to cause a rotatory movement in the perforated container. The prints, therefore, while they remain in this washer keep up a continual dance, moving slowly round and round, up and over, but quite separate from one another. The pipe at the right-hand side carries away the waste from the bottom of the tank, to which the heavier soda-

charged particles of water fall, and the tap can be used to drain off the water entirely when required. A public analyst has certified that a batch of prints washed in this machine were perfectly freed of hypo in one hour and a-half. The apparatus is compact, and as it can be covered up from all dust and dirt, it can be put into any cellar, or out-of-the-way corner, where there happens to be a water supply and a drain.

CHAPTER XI.

MOUNTING PHOTOGRAPHIC PRINTS.

MANY people who have got over the various difficulties involved in photographic work to their entire satisfaction, find a great trouble in the final operation of mounting the pictorial results of their efforts. Either the print will not stick to the card, or it sticks in one place and not in another, or it gets lopsided and out of the centre, or it wrinkles, or does something else of a provoking character. Let the reader follow the directions here given, and these difficulties shall disappear. First now, with regard to mounting pictures in the centre of the cards destined to receive them. This can be done without even marking the card with the faintest pencil line to guide the eye; indeed, it can be done quite mechanically by the simple device now to be described.

Procure a sheet of stout cardboard the size of the largest mounting board which you are likely to require, for the contrivance you are about to make from it is a gauge to last you for all time, and to serve for mounting pictures of any size within a certain limit. This limit is governed by the size of the sheet of cardboard you now take in hand. Find its centre by drawing lines from corner to corner, and from this centre carefully draw lines at half-inch

intervals, as shown in Fig. 19. This is your gauge, and its use is as follows. Take the trimmed print that is to be mounted, lay it face downwards on a sheet of glass, and apply the mounting medium with a stiff brush. Now raise it from the glass with the point of a knife, and transfer it, still face downwards,

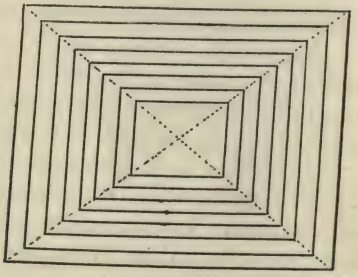

Fig. 19.—Mounting Gauge.

to the centre of your guage. You are sure to find some lines thereon which will agree very closely with the size of your picture, and only a trifling manipulation will be needed to centre it to those lines as nearly as possible. Now take your mounting cardboard, having previously ascertained which lines on the guage card it agrees with in size. Placing one edge of the mount on the line in question, which may be marked with pencil for ready identification, carefully and slowly bend the mount down on the print. The sticky side of the latter being upwards, it immediately sticks to the card. The mount is now removed, laid on its back, and the print gently smoothed down

upon it with a handkerchief. The same principle can, of course, be applied to mounting prints in an album, it being only necessary to procure a gauge the exact size of the book, and to insert it between the leaves when required. If the work be carefully done, the prints must of necessity be in the centre of the mounts.

Of the various compounds for sticking photographs on their fixed supports starch is most commonly used, and if made fresh for every batch of pictures mounted, perhaps nothing can be better. In hot weather starch, like flour-paste, quickly undergoes a change which would certainly be prejudicial to the prints mounted with it. To make the starch, proceed as follows :—Put a tablespoonful of the best starch in a gallipot which has previously been warmed with boiling water. Add to this two tablespoonsful of warm (not hot) water, and stir until all lumpiness disappears. Now fill up the pot with boiling water, stirring all the time until the starch thickens. When this change occurs, add a few drops more water, and the starch is ready for use.

Many photographers use glue to mount their prints, and it has the advantage of not cockling the mounts as starch does, but it is so tenacious that it is far more difficult to use. It is, too, somewhat troublesome to make. But this last difficulty is obviated by using the glue powder which can be bought at most oil-shops. This need only be mixed with a little hot water, and it is ready for use.

Another method of using glue is to make it up into a solution with spirit, and to keep it in a wide-

mouthed bottle, which must be placed in hot water, to melt the contents, before use. I have often used this mixture; it is not difficult to manage if the gauge plan be adopted. It certainly does not cause the mounting-board to cockle. To make this mountant, take four ounces of best glue, and soak it in water until it swells to double its former size and becomes quite flexible; then melt it in a large pot, standing in a saucepan of boiling water, with frequent stirrings. Now, add very gradually, in small doses, half a pint of methylated spirit, stirring between each addition; strain through muslin, and bottle off for use.

Before mounting, the prints should be trimmed; that is to say, their rough edges and unprinted margins must be removed. This I prefer to do before toning, for then the prints are flat and easy to manipulate. After they are fixed and dried, they generally roll up and are difficult to handle. A sheet of plate-glass should be provided to cut upon, and a cutting-glass, the size of the prints to be trimmed, is placed above the pictures during the work. The best knife to use is a sixpenny shoemaker's knife, which will require frequent application to a hone. The object of using a glass cutting-guage is, that the details of the picture can be seen through it, and the edges of the print can be cut parallel to any straight lines it contains. Another reason for trimming the prints at the stage recommended is, that they are ready for mounting before being actually dry. This is a great advantage if starch be used, for, otherwise, the prints must be laid between layers of damp blotting-paper

before the starch is applied to their backs. Cutting-glasses for all the regular sizes of photographic prints, with bevelled edges, can be bought at the shops; but a bit of plain glass—a spoilt negative may be stripped for the purpose—answers well enough provided its angles are true.

A novel method of mounting photographs was demonstrated some time ago by Mr. Cowan before one of the photographic societies. It presents great advantages both in rapidity and absence of cockling, but it requires the possession of a rolling-press.

The prints, when taken from their last washing-water, are placed in a heap on a sheet of glass, which is reared on end so as to allow the water to drain from them. When they are free from surface water, each print is raised from the mass, and receives a coating of starch-paste. The starched prints are now put on canvas-covered frames to dry, the frames being supported a few inches apart, one above another, so as to economise room and to keep the pictures free from dust. When the prints are dry, the mounting-boards are placed in a pile near at hand, and the top one is slightly damped with a sponge and clean water. Upon this mount a print is carefully centred, its dried, starched back resting upon the damped surface of the card. The two are now put between the rollers of the press—which, by the way, are nickel-plated, so as to avoid all risk of rust—the handle is turned, and the now-mounted print comes out at the other side of the press so firmly fixed in its place that it cannot be removed without tearing.

CHAPTER XII.

PRINTING WITH PLATINUM.

THE process of printing with salts of silver must be regarded as, at present, the standard process for producing photographic pictures on paper. The results to be obtained by it—providing a really first-class negative is employed in the printing-frame—are most beautiful, and both in vigour and tone leave nothing to be desired. But there is something more required in a valued picture, and that is permanence. Silver prints have always had to bear the charge of want of stability, and there are few households which do not own certain sickly, yellow, ghost-like pictures which represent the remains of what were once brilliant photographs. If all the operations comprised under the heads of printing, toning, fixing, and washing be honestly done, and good chemicals be used, I believe that a silver print is really permanent, if it be kept unmounted. Certain it is that the uncertainty creeps in directly the print is mounted on card. The paste may be sour, or compounded of materials which will re-act upon the picture; or the mounting-board may, in the course of manufacture, have been treated with chemicals which will act in the same disastrous fashion. I have never known one of my unmounted pictures to alter in the least after some years' keeping,

but I cannot say the same of those which have been mounted on card in the usual way.

But, of late years, a totally new method of photographic printing has been introduced, which is not only undoubtedly permanent but has several advantages in other ways. In this new method, which is known as the "platinotype process," a salt of the metal platinum instead of silver, is employed. Among the advantages claimed for it are the following: The prepared paper is so sensitive to light that on a dull day pictures can be produced with ease; if tested against silver prints, the time occupied in printing one picture in silver would give at least three in platinum. The manipulations are exceedingly simple; the toning, fixing, and prolonged washing necessary in the older process being entirely done away with.

The paper is supplied by the Platinotype Company in a damp-proof covering; for dampness—even that moisture which is constantly present in the driest atmosphere—is very prejudicial to its sensitive surface. For this reason, the paper is kept by the user in a tin tube, which contains some chloride of calcium to absorb any moisture that may be present. Even the joint of this calcium tube, where the lid meets the body of the box, should be covered over with an india-rubber ring to keep out the enemy. Not only must the paper be dry, but the printing-frame must be the same, and also the negative. When the paper is placed on the negative, it should be backed up with a pad of blotting-paper, freshly dried before a fire and this should be covered with a piece of india-

rubber cloth. With such precautions, the amateur need not fear failure from damp; but he must take similar precautions after the paper leaves the frame. It should be instantly returned to the calcium tube until all the prints are ready for further treatment. As very complete instructions are furnished to purchasers of materials for platinum printing, it will only be necessary here to describe in a general manner this interesting process.

The paper, as received from the makers, is, on its sensitive side, of a lemon-yellow colour. In the printing-frame this colour does not become dark red, as in the case of silver-printing; but it turns a kind of drab, the picture, when even fully exposed, having only a ghost-like form. It is during development that the true strength of the picture becomes apparent. This development is effected by dipping the print into a warm bath, containing 130 grains of oxalate of potassium to each ounce of water, the solution being kept at a temperature of 170° Fahr. This may be considered as the normal heat; but in cases of under-exposure it can be increased, and, under certain circumstances, decreased. In order to ensure the correct temperature, the development takes place in an iron enamelled dish, furnished with a thermometer, and heated below by a spirit-lamp or Bunsen burner.

The exposed paper is carefully immersed in this hot bath, so as to avoid bubbles. With a little practice this is easily done, and, if the exposure has been correctly timed, the operation of developing is complete in from five to ten seconds. Directly the

surface of the paper touches the solution, the hitherto feeble picture seems to flash out at once in all needful strength. This is apt to deceive the beginner, and he will perhaps withdraw the print before development is really complete. Seven seconds, or thereabouts, may be looked upon as the usual time to leave the prints in the dish.

After removal from the developing solution, the prints are transferred successively to three baths, each containing a very weak solution of hydrochloric acid in water; a rinse in three changes of plain water completes the work.

Platinotype prints are quite different in appearance to the usual pictures on albumenized silver paper. To begin with, they have a dull, or matt, surface, and the tone of the picture is like that of an engraving. Artists much prefer platinum prints to silver prints, as being more artistic, and it is only owing to the circumstance that the general public prefer something bright and shiny for their money that the new form of permanent picture does not make greater headway. Still, those who practice the process are constantly increasing in number, and there is no doubt whatever that people will gradually be taught to appreciate better than they do now its beautiful results. There is certainly one thing which keeps the process back, and that is its expense when compared with silver printing. As the metal platinum is about seven times the price of silver, of course this is not a matter for surprise. The price of platinum-paper is about 22s. per quire, while sensitised silver-paper

costs 14s. per quire. Many will think that the extra expense is more than covered by the wonderful saving of time, to say nothing of the non-necessity for the costly gold toning-bath. A negative that will yield a good silver print will give a good one in platinum; and very often a very dense negative, from which a really satisfactory silver picture is difficult to obtain without a terribly long exposure to daylight, will, without trouble, yield a beautiful print in platinum. The process, from the rapidity of all the operations, is one most suitable to the amateur, whose photographic work is necessarily taken up only occasionally.

CHAPTER XIII.

HOW TO MAKE GELATINE EMULSION.

ALTHOUGH many of my readers will, as a matter of convenience, prefer to buy their gelatine plates ready made, there are others who will never feel content until they can make their own. There is little doubt that if the process were an easy one professional photographers would prepare their own plates; but not one in a hundred does so. A new branch of trade has arisen in the preparation of plates commercially, since the discovery of gelatine photography. They are made by many firms of such uniformity and general excellence, that the profession are only too glad to be able to procure them thus, without the trouble and risks involved in home preparation. But the amateur photographer is differently situated altogether. He has time on his hands which he can devote to the work, and will take as much pride and pleasure in making his emulsion and coating his plates, as in the after occupation of producing pictures upon them. The work requires the greatest patience, the most rigid attention to small details, and that cleanliness and delicacy of manipulation which distinguishes the good workman from the bad. Let us begin with the important task of cleaning the glass.

Having fixed upon the size of plate we are about to make, which of course must be governed by the camera or cameras which they are intended for, we buy the glass ready cut. The description of glass known as rough sheet will do very well, if we take the precaution of looking through the batch and rejecting any which are ornamented with bubbles, or markings of a very pronounced character. A more expensive description of glass will, of course, free us from all difficulty of the kind. Put the glass sheet by sheet into a large earthenware pan, in which has previously been dissolved half a pound of American pearl-ash, in about half a gallon of warm water. Leave the glass in this mixture for half an hour or more, pour off the liquid into another vessel, for it can be used for other batches, and fill up the pan with water. Empty this away and again fill up with fresh water, to which two or three ounces of hydrochloric acid has been added. Now take out each plate in turn, rub with a linen rag on each side, thoroughly rinse under a tap, and put in a rack to dry spontaneously. When quite dry, one side of each plate is carefully rubbed with a small piece of wash leather which has been dipped in methylated alcohol and squeezed nearly dry. This alcoholic treatment is of great use in the coating with emulsion which comes later on, as it prevents a repellant action, which often occurs without it. In my own practice I wrap the plates, alcoholised side uppermost, in *clean* paper, in packets of two dozen each, and put them on the top of the kitchen hob a couple of hours before they are required

for coating, so as to warm them through thoroughly. But this is not necessary in hot weather, a time, by-the-by, which is better avoided altogether by the preparer of gelatine plates.

For general landscape work, which is the aim of most amateur photographers, a plate of medium rapidity is much preferable to one of great quickness. I tried several formulæ before I found one that I considered well adapted to this class of work. It is by no means slow, but still not quick enough to be out of all control by the worker. I will presently give the details for making this useful kind of plate, but first let us see what appliances, or rather utensils, we shall require for our work.

First of all, some kind of vessel is required as a water bath to hold the various solutions which have to be kept at a certain temperature. A preserving pan of enamelled iron has long done duty for me in this respect. It is placed on a tripod stand, with a Bunsen gas-burner below it, which can of course be turned up or down as required. Failing gas, a spirit lamp can be used instead. In this vessel, in company with a thermometer, graduated to above the boiling-point of water, stand in water the different pots required—one is a glass bottle, of a tall shape, so as not to occupy much room, the other is a 2 lb. marmalade pot. Before being used, each vessel is washed most carefully in boiling water, and carefully mopped and rinsed out, in case of any accidental impurity.

We can now take our pair of scales and weigh out

the chemicals required, taking the pr[illegible] ir-nish each scale pan with a new piece of [illegible] per for each chemical weighed. In this formula the chemicals required are as follows :—

Autotype Gelatine	...	...	...	**300 grains.**
Bromide of Potassium	...	...	...	**185 ,,**
Water	...	...	...	**5 oz.**

The gelatine, after being weighed, can be cut up into ribbons with a pair of scissors and put into the marmalade pot. Add to this the five ounces of water and the bromide. By pressing down the elastic gelatine with a glass rod, it soon gets thoroughly wetted and soft, and can be set aside to swell with the water it imbibes.

Next weigh out 231 grains of nitrate of silver, and put in the *bottle* together with another 5 ounces of water. If ordinary tap water be used the mixture will probably turn milky in appearance, but this is of no consequence. Agitate the bottle gently until the crystals are dissolved; they can also be assisted to do so by crushing them under the water with another glass rod. Be very careful not to use the one already wet with the bromide solution. When the crystals have all disappeared, add to the silver solution, drop by drop, stirring it meanwhile, strong liquid ammonia 880°. This will cause an immediate precipitate of coffee-coloured oxide of silver, but continue to drop in the ammonia, and stir the mixture until it as suddenly becomes as clear as water. Both vessels can now be put into the preserving-pan, in which warm water is poured until the thermometer indicates 95°

Fa[illegible] account must this heat be exceeded, or t[illegible] batch of emulsion may be irrevocably spoil[illegible] By carefully regulating the height and distance of t[illegible] flame beneath the pan, the temperature can easily be made constant.

In about twenty minutes the gelatine will have become viscous, and with diligent stirring all lumps will soon disappear. It is important that this should be the case before the next operation. The gelatine mixture should be wholly liquefied. All the foregoing operations can be conducted by white light—daylight, if you like: but now the red lamp must be lighted, or the red screen drawn over the window, for the two compounds we have made, now quite insensitive to light, are about to be wedded to form a mixture so sensitive that the least ray of white light will spoil it.

Before proceeding to make the combination, let us briefly consider the change that will be brought about. We have before us two mixtures, one consisting of bromide of potassium and gelatine, the other of nitrate of silver modified by the addition of ammonia. If we mix these two compounds together we form bromide of silver, which is intensely sensitive to light, and we also form something which we do not want, namely, nitrate of potassium (saltpetre). By an after operation called washing, we get rid of this soluble nitrate, leaving the insoluble bromide, which we want for our plates, freed from it. It will be seen, then, that this combination which we are about to form results in a kind of double decomposition.

It is found in practice advisable to add the silver very gradually to the gelatinous mixture, as the silver bromide is in that case formed in finer particles than if the operation were unduly hurried. Many contrivances, some absurdly elaborate, have been recommended for this operation, but I have over and over again succeeded well by pouring the silver solution in a thin stream from a jug with a good spout into the gelatine mixture, whilst stirring the latter vigorously with a glass rod. Latterly, however, I have adopted a plan which is far more convenient and effectual.

Take a piece of glass tubing about four inches long and three-eighths of an inch in external diameter. Soften one end in the flame of a spirit lamp, and draw it to a point. Break off this point with a pair of pliers, and a very small orifice will remain at the end of the tube. By means of an inch of black indiarubber tubing join this pointed glass tube to a glass funnel, and stand the whole on a retort stand, as shown in the annexed figure. Just below the point stands the pot of melted gelatine, which must be kept stirred from the moment that the silver solution is poured in above. When the mixture is complete, add one ounce of water to the bottle which contained the silver solution, rinse it out, and empty that too into the funnel to add to the newly-formed emulsion.

The gelatino-bromide of silver ought now to have a rich creamy appearance, so far as can be judged in the dull light to which we are limited, but a drop or two can be spread on a piece of glass and taken out into

another room to be examined. By transmitted light it should appear violet-coloured, that is to say, held to the eye in front of a gas lamp, the flame should appear to be of that colour. To complete this stage of the process, it now only remains to cover the jar with a lid of light-tight paper, and to let it remain in the hot-water bath for half an hour, but without any flame below, which indeed should have been removed before the solutions were combined. At the end of that period the emulsion is poured into a shallow dish, and put away in a cool place, thoroughly screened from light, to set. My own plan is to shut the dish up in a box, and to let it remain there for a couple of days or more, as it gains in sensitiveness by ripening in this way. I have sometimes left it for more than a week without any mishap.

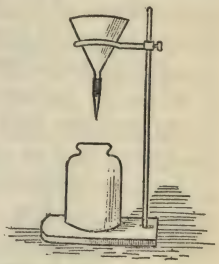

Fig. 20.—Emulsion Mixer.

Next follows the important process of washing, which it will be remembered is for the purpose of dissolving out the nitrate of potassium, which was the secondary and undesired product of the chemical combination we have made. The most effectual way to do this, is first of all to divide the emulsion, now in the form of stiff jelly, into small shreds, so that it will present innumerable surfaces to the washing water, and the particles of nitrate will be quickly attacked by that solvent. To do this effectually procure a square

of coarse canvas, such as is used as a basis for Berlin wool-work, damp it thoroughly, and forming it into a kind of bag place the jelly within it. The emulsion should not be touched with the hand, but can be gathered out of its dish with a *silver* spoon. Have ready a large and deep earthenware pan of clean water, transfer the bag of emulsion to this, and whilst holding it below the surface, twist and squeeze it with your hands until the jelly is forced through the meshes of the canvas like so much vermicelli. It will rapidly sink to the bottom, when the pan can be carefully tipped up, and the supernatant water poured off. Fill it up again, wait five minutes, and once more pour off. Repeat this eight or ten times, thoroughly agitating the emulsion every time that fresh water is added, when it may be considered quite free from soluble salts. I have the advantage of a workroom fitted with a sink and tap, so that this washing operation can be conducted with the greatest ease. Those not so fortunate can carry out the operation quite as thoroughly with a pail and can of water, but there is certainly the carrying and fetching of that pail and can to be considered.

In order to strain the emulsion, I use an earthenware colander, which can be bought of large size for about sixpence. Into this I put a wet handkerchief, the corners projecting over the sides. The emulsion emptied into this, which meanwhile may stand in another pan, the corners of the handkerchief are gathered together, and the water soon runs away. Two ounces of methylated spirit poured into the

middle of the mass just afterwards, and also allowed to drain away, has a most beneficial effect. The emulsion can now be spooned up into a clean jar prepared for it (one with a lid is best), tied over with paper and put away until the time comes for coating the plates. As this is a most important part of the business, where many fail, an entire chapter will presently be devoted to its consideration.

I have already indicated that these ammonia-nitrate plates are only fairly rapid, but Mr. W. K. Burton has published a modification of the process by which he has obtained very rapid plates indeed. The secret of his method is the employment of a considerable quantity of alcohol, and an anti-septic (salicylic acid) from the very commencement of operations. His formula stands thus :—

A	Methylated Spirit	10 oz.
	Salicylic Acid	100 gr.
B	Silver Nitrate	400 gr.
	Water	7 oz.
	Converted to Ammonia-nitrate Solution, making about	8 oz.
C	Nelson's No. 1. Gelatine	80 gr.
	Ammonia Bromide	280 gr.
	Ammonia Iodide	24 gr.
	Water	5½ oz.
	Solution A	2½ oz.

The solution C is heated until the gelatine is quite liquid, the presence of the alcohol necessitating a rather high temperature. The silver solution B is then added cold to C, using the precautions already described. The emulsion is now heated to about

140°, until it changes its colour. This can be observed by spreading a little on a piece of glass as before. At first, the colour by transmitted light will be orange, but when the highest state of sensitiveness is reached it turns to blue. When this change occurs the emulsion is poured into a dish to set, and after a couple of days' rest is squeezed through canvas and washed, and can subsequently be used for coating plates.

The most general way of forming a *rapid* emulsion is by the boiling method. The emulsion is first of all compounded with a very small quantity of gelatine, the bulk being added at a later stage. The reason of this is, that gelatine which has been kept at a great heat for any time loses its property of setting; and plates could not, of course, be made with an emulsion which insisted on remaining liquid even when almost cold. I here give a formula, which in my hands has given capital results; it may be taken as a type of the various formulæ which have been published.

Ammonia Bromide	**120 gr.**
Gelatine	**30 gr.**
Water	**4 oz.**

Apply sufficient heat to melt the gelatine, and stir it occasionally until it is perfectly liquid. Now add three drops of dilute hydrochloric acid (water ten parts, acid one part).

Silver Nitrate	**200 gr.**
Distilled Water	**3 oz.**

Mix as before, and then boil for about one hour, or one hour and a half, shaking well at half-hour

intervals, and examining on a glass strip for the colour test. The best way to boil the emulsion is to place it in a German glass flask, and to support the flask upright in a large saucepan, with a cloth at the bottom to prevent the glass touching the vessel. A piece of flat wood with a hole in it to admit the neck of the flask, and made to fit tightly between the upper sides of the saucepan, will complete the arrangement. An earthenware pot may be used in place of the flask if desired. When the emulsion has cooled down to about 100° Fahr., which may be judged by placing the back of the hand against the flask, 270 grains of gelatine are added, and the mixture is kept at a temperature of about 90° until all is dissolved. It is then poured out to set as usual.

Mr. A. L. Henderson lately brought before one of the photographic societies a method of cold emulsification, by which he obtains very great rapidity. Indeed, with plates made with the emulsion so prepared he produced his celebrated pictures of the Derby racecourse. The description of this method will give me an opportunity of describing an alternative method of washing emulsions of all kinds, which, though somewhat expensive, saves a vast amount of time and trouble. First for Mr. Henderson's formulæ, which may be given in his own words.

"I venture to say that boiling or stewing is not only unscientific but uncertain; now, if we add something to the emulsion which will prevent decomposition, one element of failure is got over. Of the various substances tried, I find alcohol and ammonia

the best. Here I have a solution of gelatine of ten grains dissolved in one ounce of water. When the gelatine is dissolved by gentle heat I add :—

"Carbonate of Ammonia (which causes effervescence)	20 gr.
Bromide of Potassium	150 gr.
Iodide of Potassium	2 gr.
Alcohol	3 oz.
Liq. Ammonia 880	60 minims.

"Mix the ammonia and the alcohol together before adding to the gelatine. This mixture may be kept in bulk ready for use; it will keep good for a long time. When it is quite cold, I stir in

"Silver Nitrate	200 gr.
Water	2 oz.

"I occasionally shake it, and in one hour it will be ripe enough for all ordinary purposes; in fact, when finished, it will give results twice as rapid as most commercial plates.*

"The maximum sensitiveness seems to be reached in about ten hours. No further advantage is to be derived from prolonging the emulsification, except that of convenience. To the above quantities I add four to five drachms of dry gelatine, and warm gently to dissolve the same."

(Now comes the washing method, which as I have already said can be applied to any gelatine emulsion

* It is only fair to say that, since the publication of Mr. Henderson's paper, several makers have introduced plates commercially of greatly increased sensitiveness, so that his words would hardly apply to the present date.

formula with great advantage. It depends upon the fact that alcohol added to gelatine emulsion will not only precipitate the mass of gelatine and bromide of silver, but it will abstract from them the useless soluble salts. The alcohol—methylated—is used warm, and poured into the emulsion, which is, during the operation, stirred with a glass rod. Mr. Henderson's directions will now be understood.)

"When the gelatine is thoroughly dissolved, I stir in twelve ounces of warm methylated alcohol, 100°. The emulsion when cool will be precipitated to the bottom of the vessel. It is to be broken up, and well washed in a running stream for some hours. Make up the bulk with water to eight to ten ounces. (The washing in water can be easily managed, by placing the broken emulsion in a jar, and conveying to the bottom of it an indiarubber tube from a tap. Cover the mouth of the jar with muslin, so as to let the water overflow without losing the emulsion. A very small stream will suffice.*)

"When the emulsion has been sufficiently washed, and the water added to make it up to the correct bulk (it may be put in a glass measure for this purpose), it can be transferred to a pot, and heated to about 100°, when it is ready for filtering and coating plates."

* In making emulsion by any formula, all operations subsequent to the addition of the nitrate of silver must of course be performed in the dark room, unless precautions are taken to keep all white light from getting at the mixture.

CHAPTER XIV.

COATING THE GLASS PLATES.

In taking up any unfamiliar work which involves a number of delicate operations spread over several hours, such as this art of plate-making, the beginner is apt to suffer much by want of methodical parcelling out of the various operations required. These operations, as it may have been already seen, may be roughly divided into three, and they may conveniently be done on three separate occasions, although it is just possible, if economy of time be a pressing matter, to get through the entire business in one day. But, on the whole, the following arrangement will be found the most convenient. The first work of making the emulsion, and putting the finished product away in its dish to cool and ripen, may occupy a spare evening. Another evening may be devoted to washing the emulsion, reserving the final task of coating the plates to a third occasion. Whilst the emulsion is being liquefied by gradual heat for the coating of the plates—an operation which often takes several hours—there will be plenty of time to clean and prepare the glass.

The room in which the coating is to be done must be kept as free as possible from dust, for dust in any form is a deadly enemy to gelatine plates. It should

be furnished with a good firm table and one chair, besides a rack arrangement for the reception of the finished plates. The red lamp employed should be still further protected with an orange-coloured paper cover, so that the light is reduced to the smallest quantity possible to see by. But this precaution is only necessary during the actual coating operation, when plates are necessarily lying about uncovered. My own lamp is a paraffin one, with a ruby chimney crowned with a light-tight top. Round it is a kind of wire crinoline arrangement, over which I can throw an orange-paper petticoat, of a thickness according to the work in which I am engaged.

The other articles required for coating are as follows:—a carefully-levelled sheet of plate-glass, slate, or marble, placed at the left-hand side of the table, upon which to lay the plates directly they are coated, and upon which they rapidly set; the before-mentioned preserving-pan, supported on its tripod, but with the lamp fixed in a tin box, which will let the air in to support combustion but will not let any light out (this is to keep the vessels containing the emulsion warm during the frequent pauses that must take place during coating, when plates are reared up to dry, &c); two jugs to contain the emulsion; a glass rod; a pneumatic holder; and the warmed glass plates.

During the time that these matters are being arranged, the closed pot of emulsion has been put into the water-bath, and the heat has been kept up to the normal 95°, and not allowed to go higher. After

an hour of such warming, the cover may be taken off —in the dark room, of course—and the emulsion stirred with a glass rod. This will help the heated and melted portion at the bottom of the pot to mingle with the colder portion, and, if this procedure be followed two or three times, at intervals of an hour or so, the whole is soon fit for the next operation—that of filtering.

There are several methods of filtering emulsion which I have tried, but I have found none so efficient as the one I am about to describe. There is a certain kind of paraffin lamp-glass which is now quite out of fashion, but which can be purchased without much trouble. It is of the shape shown in the cut, with a turned-up flange at the lower extremity. It is this flange which makes it so useful for our present purpose. Over the opening we first of all stretch a piece of wet wash-leather, which has previously been soaked in soda and water, and has had about twenty soakings in clean water afterwards. A piece of string tied round the flange will keep the little drum-head tightly in its place. The emulsion being all ready—and care must be taken that there are no floating undissolved particles in it, which can easily be seen sticking to the glass rod as we give it a final stir—we are now ready for the operation of filtering. The two jugs are filled with warm water, just to heat them; a little is poured into the lamp-glass, just to moisten and warm the

Fig. 21.—Lamp-glass.

leather; and one of the jugs is emptied and placed immediately below. The emulsion can now be poured into the glass, when it will easily run through the leather—particularly if the mouth be applied at the top of the glass, and a steady pressure of air kept upon the quickly-descending column of liquid. I have advised the use of two jugs because it is best to divide the filtered emulsion into two halves: one can be in use whilst the other is kept warm in the water-bath. Fig. 22 represents a capital double-mop arrangement for cleaning the filtering-glass after use. Its price is one penny.

Fig. 22.—Lamp-glass Cleaner.

The operator now sits at the table, with the glass slab or slate on his left, the pile of warm glasses on his right, and near them the glass rod and the pneumatic holder. (*See* Fig. 23.) The jug of emulsion is taken in the right hand, and held in such a manner that the fingers grasp the handle whilst the thumb holds back the glass rod—which has been put into the emulsion—and prevents it tumbling to the spout, where it would considerably interfere with the pouring. The first plate of glass is now supported on the holder, and held as level as possible between the operator and the light, his left wrist resting for support meanwhile on the levelled slab. A pool of emulsion is poured on the further end of the plate, and, by slightly inclining the surface, can be made to run slowly over the entire plate; but it is generally requisite to coax it a little with the glass rod. After

a little practice it becomes easy to guess the amount of emulsion requisite to coat a plate of given size. A pool the size of half-a-crown ought, when spread out, to cover a quarter-plate, but this is necessarily a matter of practice. The glass plate is now gently

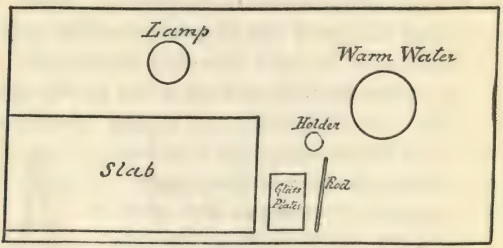

Fig. 23.—Arrangement of Table for Coating Gelatine Plates.

rocked, and is finally put on the levelled slab to set. Each following plate is treated in the same way, until the slab is covered with finished plates. The ones first coated will by this time have set, and can be reared up to dry in a rack provided for the purpose, in a regular drying-box, or in the skeleton drying-rack which I recommend, and which I describe in detail presently under the name of "my photographic four-poster."

When the slab is once more clear of plates, a second batch can be coated, this time employing the other jug of emulsion, which is warm and ready for use—jug No. 1 having been put in the water-bath ready for the third batch—and so the simple operation goes on until the stock of emulsion is exhausted. I say "simple," because there is really no great art in

the matter; but there is a certain knack, which can only be acquired by practice, and then the task of coating a gross of plates is one that can be got through in a surprisingly short time. But there are some people who seem to have never had the full use of their hands—some that cannot even knock in a

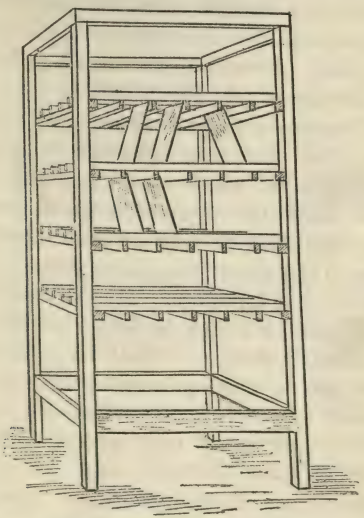

Fig. 24. Photographic Four-poster.

nail straight. These possibly will not regard this matter of plate-coating as a simple thing, but rather the reverse.

I will now describe my "photographic four-poster," which I have found the most useful piece of apparatus

that my dark room possesses. It was suggested to my mind after trying a number of different ways of drying plates, and, after some two years' experience of it, I see no reason to alter its design in any way whatever. The accompanying sketch of the erection, together with a few plain directions, will enable any one to make it for himself, unless he prefer to employ a regular carpenter for the purpose. I will give the size of mine, but, of course, other sizes may be more convenient to others. (*See* Fig. 24.)

The four posts are six feet long and one inch and a-half square. The first operation is to place these posts in pairs, and mark upon them lines indicating the places where the supports for the shelves are to be screwed. The intervals between these supports must be according to the size of the plates which are to stand upon the finished structure. My shelves are placed at different distances, so as to accommodate different-sized plates. The supports, two feet long, and made of stuff one inch by three-quarters of an inch thick, are now screwed into their places, when the pair of posts have the appearance of two ladders. The shelves must now be taken in hand, and are conveniently made before being put into position. They are made of laths, about one inch by three-eighths of an inch, which can be bought by the dozen at any sawmill. These can be carefully measured off with pencil-marks, the upper laths being spaced out according to the size of the plates which are to stand upon them, the lower ones being intended for the top edge of the leaning plates to rest upon. At each point of cross-

ing, the junction must be made good by one French wire nail.

When the shelves are all in position, the general structure can be screwed together with tie-pieces, the back and sides filled in with black glazed calico, and a blind of the same material fitted to a roller in front. In my four-poster, a closed gas-stove is fitted to the lower part; but this is not necessary for gelatine plates, which will soon dry if the room itself be not damp. The skeleton arrangement of the shelves permits a constant current of air to circulate round about the plates; but a better current can be ensured by taking advantage of the rising property of warm air, in a manner first suggested by myself in the *Photographic News*. I quote the passage in question :—

"SUGGESTION FOR A DRYING-BOX."

"Sir,—In your recent very welcome 'Seasonable Hints to Emulsion Workers,' you rightly remark that 'the real difficulty in making satisfactory and clean dry plates begins when the emulsion has been made.' I have long been of opinion that a perfect drying apparatus has still to be contrived. If the plates are left to dry spontaneously, it is often thirty-six hours, or even more, before the last obstinate wet patch disappears. During all this time, the plates are liable to be covered with the dust which is present in the cleanest room, and opaque spots in the finished negative are the result. The many drying-boxes which have been planned and described in your columns possess one disadvantage in the requirement of a flame from

which not only light can steal, but from which there is chance of danger from fire. These difficulties have led me to devise a plan whereby a steady heat and draught may be maintained without actual fire or flame. The solution of the problem is found in a solution not unknown to photographers, namely, one of acetate of soda. It is well known that the admixture of certain salts with ordinary water raises the boiling-point of the liquid far above the stereotyped 212°. Acetate of soda stands, I believe, at the head of the list in raising the boiling-point to 256°.

"My suggestion is, that at the bottom of the drying-box (which should be pierced with holes for the admission of air) should stand, on four short feet, a metallic vessel filled with a boiling solution of the soda. This hot box would cause a constant draught of warm air to rise to the plates standing in racks above it, and the retained heat would dry the thickest film in a few hours. This method of heating has already been applied in France to railway foot-warmers, and the following experiment recently tried with one of them will show how such a vessel is capable of holding heat for a long period. A foot-warmer, on being charged with its hot solution, registered 253°. At the end of some hours, when again tested with a thermometer, it registered 211°, or only one below the boiling-point of water. I see that a Dresden chemist has lately constructed a stove on the same principle; but the mixture he uses (for which an improvement is claimed) is one part of acetate to ten of hyposulphite. This stove is said to act well.

"I must apologise for the crude form in which my suggestion is offered, and I trust that those who have time to experiment in this direction will publish, for the benefit of others, the results obtained.

"T. C. HEPWORTH."

The four-poster is highly useful for other purposes than the mere drying of newly-made plates. It can be used as a rack for glasses when they have received their final rinse under the tap after washing. It will serve the same purpose for negatives, which will quickly dry in such a position, particularly if the erection be brought close to a fire. At other times it will form a nest of useful shelves, where cardboard, paper, glass, and other things can be conveniently stored. It may be modified in various ways to suit individual wants. Thus it may be convenient to shorten the legs, so that the thing can stand on a vacant table. Or the same kind of shelves can be fitted to an existing cupboard, in which case efficient light-tight ventilation must be strictly enforced. Altogether, I am well pleased with the success of the contrivance, and trust others may be the same.

It is advisable not to move the plates until they are quite dry. In favourable weather this will occupy about thirty-six hours, sometimes longer. When dry, they must be packed carefully away for future use. That this packing is a matter of some moment, let the following story testify. A pupil of mine, who had made a successful batch of plates, took them with him on a photographic tour in Devonshire. They

were properly packed in the first instance, but after exposing them in his camera, he hurriedly every night packed them away with a piece of newspaper between each. Some weeks afterwards he developed the batch quietly at home, and found to his dismay that each picture was covered over with portions of the leading articles which had been printed on his wrapping papers. The printing ink had in some way affected the delicate chemical surface, and the result was as I have described.

I believe that the best plan of packing plates is to place them face to face in pairs, with a ribbon of sugar paper so folded at each opposite end, that a fold just prevents the surfaces from touching. Another good plan is to put a piece of new yellow tissue paper between each plate. White paper should never be used, because sometimes it is sufficiently phosphorescent—but quite invisibly so to the eye—to affect the sensitive chemical surface. My own plan is to use the sugar paper, and to pack the plates in dozens, first in orange paper, and then in brown paper over all. Each package is tied up with string, and is labelled with the date of making, and any notes as to particulars of process which it may be useful to preserve.

CHAPTER XV.

PRODUCTION OF TRANSPARENCIES FOR LANTERN SLIDES, ETC.

A VERY beautiful application of photography is the production of positive images on glass for window decoration, but more especially for slides for the optical lantern. Before the advent of photography, the pictures for this latter purpose were drawn and coloured on the glass by hand. Some of the finest things ever produced in this way were painted some thirty years ago for the old Polytechnic Institution, London, and I believe that in some cases as much as £20 was paid for a single picture. Their size was about eight inches by five. But directly photography came to be applied to the same purpose, with its wondrous command of detail, the standard size became reduced to three-and-a-quarter inches square, and the most beautiful effects were at once attainable at a fraction of the former expense.

Although the amateur can never hope to compete with those whose business it is to exhibit lantern pictures fifteen or eighteen feet in diameter, still he can, by means of the very efficient lanterns burning paraffin oil, which are easily managed, cause endless delight to himself and his friends, by exhibiting on a screen large reproductions of the scenes which he has

visited, or life-sized portraits of friends known to all his circle. The work of producing positives on glass from his negatives is best carried on by gas or lamp-light, and can well occupy the long winter evenings when other photographic work is at a standstill. I hold the belief that no one has observed all the beauties of a good photograph until it is exhibited by the aid of the lantern, and I fancy that most people will, when they have practically tried the question, be of the same opinion.

Glass positives, $3\frac{1}{4}$ by $3\frac{1}{4}$, can be taken in the camera, or direct from the negative by contact in a printing frame. The first plan is necessary when the negative is so large that it has to be reduced to the standard lantern size. But if the operator has produced his pictures with a quarter-plate camera, or even a 5 by 4, the contact plan can be adopted. We will now consider both methods in detail.

In copying a negative by daylight, a room, if possible, should be chosen for the work the window of which affords an uninterrupted view of the sky, without the intervention of trees or buildings. Such a room can generally be found, even in London, at the top of the house. Upon a table in front of the window place a lidless box, in the bottom of which is cut a hole the size of the negative to be copied. (*See* Fig. 25.) The said negative may be placed therein, or it can be fixed against the window pane with brown paper pasted all round it. The varnished side of the glass must be towards the room. Exactly opposite the negative, and so placed that the lens is at the same height as

its centre, is placed an ordinary camera, the dark slide of which is fitted with a carrier to take a $3\frac{1}{4}$ by $3\frac{1}{4}$ plate. The most suitable lens to use is a short focus, portable-symmetrical; but others can be ap-

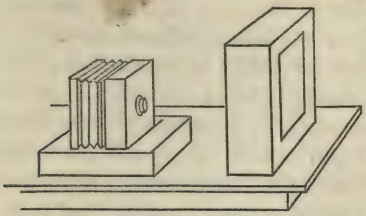

Fig. 25.—Arrangement for Copying a Negative in the Camera.

plied to the purpose. The gelatine plate for taking the positive can be prepared by the ammonia-nitrate process, as described on page 110.

On plates prepared by this formula I have taken most beautiful transparencies, showing every gradation of tone in the most perfect manner.

The negative must be carefully focussed on the ground-glass screen of the camera. The exposure on a bright day, and with a normal negative and the above-named lens, using No. 4 stop, will be about half a minute. If, however, the negative is unusually dense, or yellow in colour, it will take much longer. A great difference in exposure will also be necessary, according to the method by which the original negative has been developed. If by the ferrous-oxalate plan, the exposure will be little more than half that required if the negative owes its existence to pyro. After exposure the plate is developed by the ferrous-oxalate method, using an

extra quantity of bromide. It must be allowed to develope until it appears darker than intended to be when finished. The usual operations of fixing and washing are then proceeded with. A slight opalescent veil, due to the lime in the water which manifests itself on a plate developed by this method, I have already adverted to in the chapter on developing. This, of no detriment to a negative image, is far from being the case where a lantern picture is concerned. It must be got rid of, or it will give the picture by transmitted light a sickly yellow colour. This can be readily done after the picture is fixed and washed.

Dissolve in a cup half an ounce of bicarbonate of soda, with three ounces of water. Add to this gradually sufficient citric acid in powder to neutralise the alkali, and to leave the solution slightly acid to litmus paper. Immerse the picture in this liquid, and rub it lightly at the same time with a cotton-wool pad soaked with the same. In a minute or two the lights of the picture will be as clear as glass. The picture is then washed in one or two changes of water, and dried. If properly exposed it will require no intensifying, for the density will be quite sufficient without it. If, however, intensification is needed, it can be done by one of the formulæ already given. When daylight, for want of opportunity, is not available, gas-light can be used to illuminate the negative to be copied. To do this to the best advantage, enclose a broad bats-wing burner in a tin box properly ventilated, and place some distance in front of it a piece of ground-glass. About an inch

in front of this must be placed the open box holding the negative. The various operations of focussing and exposure can then proceed, but naturally the latter will be prolonged to double or treble the time required in daylight.

Where the negative is already of a suitable size for reproduction as a lantern slide, the difficulties of the matter are very much lessened. In this case gas-light is a far better medium for impressing the plate than daylight, for it is under such ready control. Here we require a good bats-wing burner in easy reach of the hand. It is turned down as low as possible, except at the moment of exposure. The negative is placed in a printing frame, just as if a silver print on paper were about to be taken from it. Upon it, a gelatine plate cut to size ($3\frac{1}{4}$ by $3\frac{1}{4}$), is carefully placed. By holding up the negative to the red lamp, the exact place for getting the most effective picture on the sensitive plate can be well judged. The back of the frame must next be put in its place, taking great care in doing so that the plate underneath is not shifted, and the whole arrangement is now ready for exposure to light.

Now hold up the frame at a distance of about 2 feet from the gas-bracket, and turn up the light for one second, or thereabouts. This exposure is for a good negative, with the particular make of plate recommended. With more rapid plates the exposure must be greatly reduced, or, what comes to the same thing, the distance between the frame and the gas-lamp must be increased.

And here the reader may be reminded of a well-known law, which is stated at length in all books on optics, but which may with advantage be briefly quoted here. "*The intensity of illumination on a given surface is inversely as the square of its distance from the source of light.*" To put the matter more plainly, let us suppose that we hold our printing frame at a distance of one foot from the gas lamp for one second, and that it is exposed double as long as it ought to be. In ignorance of the above-stated law, we might be inclined to double the distance in our next attempt, in the fond belief that the plate would then receive one half of its previous exposure. But the law teaches us that if the plate received a given amount of light at a distance of 1 foot, at 2 feet it will receive only one-fourth, at 3 feet only one ninth, and at 4 feet only one-sixteenth. This law, the application of which is soon understood, should be continually in the operator's mind when he is manufacturing lantern slides by gas-light. With a very thin negative a good positive can often be produced by increasing the distance from the source of light, and increasing the exposure accordingly. After exposure the plates are developed, fixed, and washed, just as if they were negatives, using always the ferrous-oxalate method of development.

Although, as I have said, gelatine-bromide plates are capable of yielding very fine results, these results are not obtained without considerable experience. A far easier plan for the beginner is either to buy gelatine-chloride plates which are sold for the purpose,

or to make them himself. When he is once accustomed to emulsion-making, the manufacture of the chloride plates will present no difficulties; indeed, they are far easier to make than the bromide plates, for they can be prepared by yellow light, and plenty of it too, so that the worker has not the inconvenience of working in semi-darkness. I have obtained the best results from the following formula :—

Mix in three separate vessels the following—

Gelatine	300 gr.
Water	4 oz.
Silver Nitrate	240 gr.
Distilled Water	2 oz.
Chloride of Ammonium	100 gr.
Water	4 oz.

After the gelatine has been allowed to swell for about a quarter of an hour, place all three vessels in a water bath heated to 120° Fahr. As soon as the gelatine has thoroughly melted, which it will soon do if stirred occasionally with a glass rod, pour the silver into it, and then add the chloride solution. This mixing must be done by red or yellow light only. Allow the emulsion which is now formed to remain at the same temperature for an hour, and then pour out to set. The squeezing through canvas, and washing operations, can be carried on as soon as the gelatine has set. The filtering, and coating of the plates require all the precautions already detailed in a former chapter.

The glass for lantern slides should be very thin, and free from all flaws and bubbles. It is a most

provoking thing, after producing a perfect picture, to find that its effect is quite spoilt by a bubble in the glass, or a scratch on its surface. Such a flaw is easily overlooked, but when the picture is placed in the lantern, and enlarged on the screen some dozen diameters, the intruding flaw is the first thing seen.

The glass I use for the purpose is cut six-and-a-half inches square. When coated, I have merely to cut it across twice with a glazier's diamond, and I have four plates for lantern slides. Some little care is required in cutting a gelatine plate, or the film will peel off the glass. I use a board with a ledge at one end, against which one side of the glass plate rests. On the top of the plate I put a kind of ruler $3\frac{1}{4}$ inches in width, all but one-sixteenth. This is to allow for the width of the diamond. I then run the latter along the glass, using the ruler as a straight edge, and the glass is cut from end to end. I now snap it backwards, so as to break the glass along the cut without separating the two halves which are held together by the gelatine film underneath. A rapid snap the reverse way breaks the gelatine along the cut edge. By the use of this board, and straight edges of different widths for different sizes, plates can be cut by feeling, more than by sight, in the feeblest of light.

Gelatine-chloride plates are something like 100 times less sensitive to light than are bromide plates. Five seconds to diffused daylight will answer for good negatives. If it be preferred to work by gas-light, the printing frame may be hung up about 8 inches from the burner, when the necessary exposure will be from

two to two-and-a-half minutes. I find that the usual ferrous-oxalate developer gives capital results with the plates mentioned. Mr. Cowan gives three formulæ, by which differently-toned pictures can be produced, and I append the directions for compounding them which he supplies with the plates commercially.

OTHER DEVELOPERS FOR CHLORIDE PLATES.

No. 1.—For Cold Tones.

Potass. Citrate	136 gr.
„ Oxalate	44 gr.
Hot Distilled Water	1 oz.

No. 2.—For Warm Tones.

Citric Acid	120 gr.
Ammon. Carb.	88 gr.
Cold Distilled Water	1 oz.

No. 3.—For Extra Warm Tones.

Citric Acid	180 gr.
Ammon. Carb.	60 gr.
Cold Distilled Water	1 oz.

To three parts of either of these add one part of the following at the time of using :—

Sulphate of Iron	140 gr.
Sulphuric Acid	1 drop.
Distilled Water	1 oz.

To develope, place the exposed plate in a porcelain dish and flood over with sufficient of either of the above developing solutions, keeping the dish rocking; the time required will vary from one to ten minutes, according to the developer used and the density required. No. 1 is the quickest, No. 3 the slowest developer.

A great variety of tones may be obtained by mixing the first and last developers together in different proportions, and altering the exposure to suit the developer.

The addition of from five to ten minims of a 10 per cent. solution of sodium chloride (*i.e.*, common salt) to each ounce of developer will considerably modify the colour and allow of much longer exposure, and is valuable when very rich warm tones are required.

After the lantern slides have been dried in a situation free from dust, they must be mounted. For this purpose a black paper mask, with a round, square, or cushion-shaped opening (these can be bought) is placed over the photograph, and another glass carefully cleaned is placed above it. The two glasses, with the mask between them, are now bound together with a slip of thin black paper a quarter of an inch wide and 14 inches long, wetted with starch paste.

Transparencies on gelatine plates can also be used for other purposes than lantern slides. Stereoscopic pictures of great beauty can be thus prepared, also decorations for windows. Both these must be backed with ground glass, or with such a substitute as the following, which is recommended for the purpose by Captain Abney.

Put shreddings of white wax into ether, until no more will dissolve. To every ounce of this mixture add another ounce of ether, and flow this solution over the back of the transparency. In a few hours this will give a matt surface to the glass.

CHAPTER XVI.

MAKING ENLARGEMENTS.

The gelatine process, which has so simplified the practice of photography for amateur workers, has also come to their aid by suggesting an easy means by which their small negatives can be made into large positives. From a really good negative—and no other kind is worth the trouble—a picture enlarged up to ten diameters can be produced, which will be found well worth framing. For this particular purpose the gelatine emulsion is spread upon paper, instead of the usual glass support; but there are so many real difficulties to be overcome in the process that I would strongly dissuade amateurs from attempting to make the material for themselves. It can be bought at a reasonable price, and perhaps cheaper in the end than the amateur worker could produce it for himself.

Where quarter-plate negatives only are to be dealt with, the simplest and quickest plan is to use the negative as a lantern slide, and by means of one of the lanterns now sold, which burn mineral oil (*see* Fig. 26), he can project the image of the negative on any flat surface, such as a drawing-board covered with white paper and supported on a wall. The negative must have its film side away from the light, when the image will be projected on the board in its correct

position. If the negative be turned the other way, the picture will be reversed, as if it were viewed by means of a looking-glass.

The image having been most carefully focussed, and the lamp burning at its best, the lantern lens is covered with a cap, but not before the limits of the picture have been roughly marked out in pencil on the board. This marking is to assist the operator in

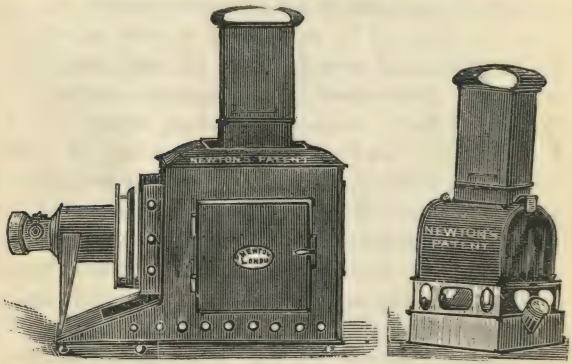

Fig. 26.—Mineral-oil Lantern and Lamp.

fastening the gelatine paper in the right position, so that the image will fall upon it, and not beyond its edge. The following operations are conducted by the light of the red lamp. A sheet of paper of the right size is taken from the cardboard box in which it is supplied by the manufacturers, and carefully unrolled with clean dry hands. Its sensitised side will be found innermost, and the best plan of procedure is to take it direct to the drawing-board,

upon which the image was just now focussed, and placing its free edge against the topmost pencil-marks to pin both corners there (drawing-pins can be used, but I much prefer steel pins about one inch long, with black bead heads, such as can be bought at the linen-drapers. They are much easier to handle in the dark). The sheet is now unrolled, and its bottom edges pinned also; it may, if large, require a pin on either side in the middle to prevent bulging. An alternative plan is to wet the gelatine paper in a dish of water, and to cause it to adhere to the board by the moisture which it holds. In this case the board should have a smooth painted surface, or should be replaced by a sheet of glass. The exposure can only be judged by experience, but such experience can be gleaned by experimenting with narrow strips of paper, and exposing different parts for different times. Thus, suppose we took a strip of the gelatine paper, and ruled across it pencil marks, so as to divide it into six parts. Pin this on the board so that the image of the negative falls upon it. But cover all the divisions but one with a shield of orange paper. Expose for one minute, now move your shield to the next division for another half minute, and so on until the last division has had its half minute of exposure. You can now note in pencil on the divisions the various exposures they have had, the last one being half, the next—one, the next—one-and-a-half, and so on. Now develope the strip, and you will see which division has had the correct amount of light. As a rough guide, I may mention that a good negative enlarged from $3\frac{1}{4}$ inches

to 12 inches will require an exposure of about two minutes.

The Argentic paper is manufactured by Messrs. Morgan and Kidd, of Richmond, and is sold in various sizes and quantities. Full directions for development accompany each roll of paper, but in the main the methods used are identical with those already recommended for plates. Although both the pyro and oxalate processes may be adopted for paper, the latter is, in my opinion, by far the better of the two. I have had some little experience in working with the material: for I have used up, principally in lecture demonstrations, more than 600 square feet of it.

After exposure, the paper, if it has not been already wetted, is soaked in water in a large dish. The water must be made to flow all over it, and a pad of cotton-wool, a piece of sponge, or clean fingers, can be used to help in the work. When the paper lies quite limp and soft, the water is poured away, and the developer is applied. (A good dish for the purpose can be made of wood, and painted with two or three coats of oil-colour, or covered with some waterproof material. Another good plan is to use a square of mackintosh cloth, tacked loosely to a frame of wood.)

Unless a wasteful quantity of developer be applied, the dish must be rocked, so that the developer moves uniformly over the surface. The image will soon appear, and the action must be stopped by pouring off the developer and rinsing two or three times with

water before quite sufficient density is obtained; for the image gains in strength when the fixing agent is applied. The paper must now soak in hypo and water—using plenty of liquid—and when fixation is complete, which can be judged by looking through the print at a gas-flame, it must be washed in many changes of water. A slight yellow tinge, which the paper receives from the iron developer, is afterwards removed by very dilute sulphuric acid. The strength of this solution, and other details of the process, can be gleaned from the published directions accompanying the paper.

In the absence of a proper magic-lantern, the amateur can, if he is gifted with constructive powers, make a simple contrivance for himself; that is to

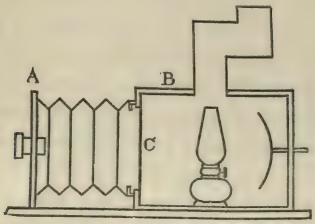

Fig. 27.—Section of Enlarging Lantern.

say, if he can handle a few tools intelligently. The lantern body may be made out of a small packing-case, with a door fixed on to where the lid should be. The case will stand on its side, and its general arrangement of parts can be understood by reference to the sectional drawing (Fig. 27). The

box stands on a base-board double its own length, and in front of it is an upright piece of wood, A, in which is fixed the lens. A is connected with the box B by a bellows. This bellows can be easily made, or a sleeve of black material, with hoops of brass wire inside at frequent intervals, and india-rubber bands outside to keep the hoops in position, may be used. A good paraffin lamp, or Argand gas-burner, can be used as the illuminant, with a silvered concave reflector behind it, fixed on a rod projecting at the back of the box for easy adjustment. The roof of the box should be covered round the hole for the chimney with tin-plate. In front of the box is an aperture, filled in with a sheet of ground-glass, and in front of this again are grooves, top and bottom, to hold the negative to be enlarged. The image is received on a screen, as already described; but the exposure will be longer than with a lantern possessing condensing lenses behind the negative, as in the ordinary magic-lantern arrangement. The form of the chimney is quite immaterial, so long as it possesses a bend to keep in the light from the lamp within. A foot of ordinary stove-pipe, with an elbow-joint, would answer the purpose admirably.

Those who have time and opportunity to work by daylight can do their enlarging without even such simple arrangements as those just described; and I think that the intelligent reader, having noticed the principle upon which the apparatus must be based, will have no difficulty in contriving the means to admit the light from an ordinary window to serve his

purpose. If he have command of an upper window, giving an uninterrupted view of sky, his work will be simplified. First of all, nail two laths across the window, to hold an ordinary printing-frame the size of the negative to be copied. Place the negative therein, and secure with pins, for the back of the frame must be taken out. Now cover up the remainder of the window with brown paper, so that the only light coming into the room from the outside is through the negative itself. The bellows arrangement, or an ordinary camera, can now be supported on a shelf in front of the negative, and the view can be focussed and dealt with as already described.

Where several enlarged positive copies of a particular negative are desired, it is best to make an enlarged negative to print from in the ordinary manner. There are two methods of doing this. In the first place, we can obtain a transparency by contact, as detailed in the chapter dealing with that branch of photography; then, by means of the enlarging apparatus, we can get an enlarged negative from that positive. The alternative method—and the best, I think—is to get the enlarged positive first, then touch it up with Indian ink, if required. Now wax the positive by laying it on the top of a hot plate—the top of the kitchen-oven, for instance—and rubbing it all over with a hot iron, with a lump of white wax running before it as it moves. A piece of clean blotting-paper laid above it, and another application of the iron, will remove superfluous wax. With such a prepared positive to work from, a negative may

be readily obtained by contact in an ordinary printing-frame on albumenized paper. This negative is in its turn coated with wax, and as many positives as desired can be printed from it.

CHAPTER XVII.

FAULTS AND THEIR REMEDIES, AND SOME USEFUL HINTS.

If plates are coated in warm weather, or if dried by too much heat—and sometimes from some unknown cause—they will blister or frill soon after the developer is applied to them. In some cases, the plates will show no sign of this most aggravating fault until put in the fixing-bath. In this latter case, dilute the bath with half its bulk of water. If they frill under development, try some of the following remedies:—Rub a composite candle all round the edge of the plate before wetting the film; mix with the developer 20 per cent. of methylated spirit; let the preliminary soaking of the plate take place in a strong solution of Epsom salts instead of plain water. In very obstinate cases, coat the plate with a layer of plain collodion, in the same way as when varnishing, before wetting it. N.B.—A large batch of plates which I made some time back frilled so badly that the film creased up and floated off the glass directly the developer was applied. I put aside these plates for three months, and found, on again taking them in hand, that the fault was entirely absent.

Wavy markings on a developed plate may generally be traced to dirty dishes or developing-cups. These should be rinsed out with a mop or brush kept

for the purpose, previous to developing each picture. The dark stain on both cups and dishes will readily yield to a little citric acid and water. Finger-stains can also be removed by the same harmless agent.

Spots on the plate are often due to dust in the dark slides or changing box. The remedy is obvious. Larger round spots, which look like clear glass in the finished negative, are the result of bubbles resting on the film during development. These seldom occur if the plate be soaked in water first of all, but, in some cases, the film is very repellant, and bubbles will come. A flat camel's-hair brush, moved over the film when first put in the developing-dish, will at once cure this evil.

The amount of bromide in the developer will require to be modified according to temperature. If in hot weather a given amount of bromide gives a good result, the quantity must be greatly reduced when the temperature is much lower.

Plates which are known to be under-exposed should be kept before development for some weeks, for it is a known fact that when once the film has been acted upon by light, a kind of continuing action will go on afterwards, although the plate be kept in absolute darkness. Travellers going abroad with the intention of not developing their plates until after their return home, should bear this fact in mind, and give a slightly shorter exposure than they would under ordinary circumstances.

In travelling always carry some ruby cloth or paper, for with it, in case of need, a band-box can in a

minute be turned into a red lamp. It will also do for daylight, when the larger part of an ordinary window has been filled in with common brown paper.

In alkaline development sufficient fluid should be used to entirely cover the plate, and the dish should be kept still. The resulting negative has a much better colour if this rule be observed. If not, the air gets to the surface of the film, and oxidation leads to discoloration.

Glass-tubing can be bent in the flame of a spirit lamp, or Bunsen's burner. Approach the glass gradually to the flame from above, then turn it gently round and round, letting the flame play equally upon the part where the bend is to come. The glass will soon get soft, and can be bent as desired.

If the ground-glass screen of the camera be broken and cannot readily be replaced, white wax dissolved in ether and flowed over the surface of ordinary glass, will answer the purpose. White tissue paper gummed on glass, will do for a makeshift.

To get a fine grain on glass, rub two pieces together by placing one horizontally on a table, and moving the other in a circular direction upon it. Between the two put flour-emery, and water. In a few minutes both surfaces will be beautifully ground.

It is a good plan to fasten the lens-cap by a piece of strong twine to the brass mount, otherwise it is likely very soon to be lost. The screw for fastening the camera to the triangle may also be attached to the latter in the same way, and for the same reason.

In photographing the interior of churches, &c., where there is a smooth and somewhat slippery pavement, it is difficult to secure a firm foothold for the camera tripod. The difficulty can be obviated by three slices of wine-bottle cork to cover the points of the legs, and three yards of string to keep them equidistant.

The addition of a few drops of a very dilute solution of hyposulphite of soda (1 part soda to 200 water) to the ferrous-oxalate developer, will act as an accelerator, and will give increased density. It must, however, be used with great caution, or the plate will suffer beyond recovery.

The travelling photographer need not carry developing-dishes, if he will take with him a few sheets of parchment paper, such as jam pots are covered with, cut into pieces measuring two inches larger each way than his plates. These are readily made into dishes for temporary use by bending up the edges and holding the folded corners between American paper clips.

Plates are well packed for travelling by putting between each a little frame cut out of cardboard. The frame should be the same size as the glass plate, and should not measure more than one-eighth of an inch in width.

The iron triangle belonging to the tripod camera stand should have wash-leather neatly sewn over its limbs. This covering will protect the camera from scratches, if not from more serious injury.

If indoor portraiture be attempted, be careful that

the window of the room is specially cleaned for the purpose. A good mixture for cleaning glass is fine emery powder wetted with methylated spirit, with just a trace of liquid ammonia. A London window is really too dirty for portraiture two days after it has been cleaned.

Cheap dishes for home work may be made out of of the common tin trays sold for baking purposes, but they should first have a good coating of Brunswick black. Apply this with a brush after well warming the metal.

To remove emulsion splashes and smears from the backs of plate, or from dishes, funnels, glass rods, &c., rub them with common kitchen salt moistened with water. A piece of flannel makes the best rubber.

The diaphragms or stops of many lenses are made to rotate and form part of the lens mount. Other lenses, which from their size cannot have this arrangement, are supplied with loose stops. It is a good plan to have these fastened together with a rivet or pin, like a set of ivory tablets sold for ladies' use. In a lens of this second description, the slit for the stops should be covered with an india-rubber band when the full aperture is used for instantaneous work, otherwise light is admitted which might fog a very sensitive plate.

It is a good plan to keep near the developing-sink a small box of powdered pumice-stone, and a piece of sponge. If the latter be moistened and dipped into the powder, it presents a ready means of

cleaning the backs of plates. It is the exception to find a plate which does not need some treatment of the kind.

Use freshly-mixed hyposulphite of soda for every batch of plates which are developed, if you want the best results. The salt is cheap enough to justify a little liberality in its use.

A wooden spoon, painted with one or two coats of Brunswick black, is a good thing to manipulate gelatine emulsion with. It may be used to scrape up the unwashed jelly into its cloth, and to ladle the shredded emulsion after the washing operation.

As a general rule the camera should be kept during exposure as level as possible, but under certain circumstances it becomes necessary to tilt it up. Supposing, for instance, the subject of the picture is a high building, so situated that the photographer cannot place his camera as far away from it as he would wish to do. When focussed on the ground-glass screen of the camera, it is found that the upper part of the building is not in the picture. The camera must therefore be tilted up; but the result of this is to cause vertical lines to converge towards the top, a fault which can be corrected by restoring the plate to a vertical position by means of the swing back, with which all the best cameras are now provided.

It must be noted that all photographic formulæ are compounded by "Apothecaries' weight."

Litmus paper, both blue and red, is sold in small books. The former detects the least trace of acid in any liquid with which it is damped by turning red,

and the latter changes to blue on contact with an alkaline compound.

It is a matter of the first importance that the red light of the dark room, whether it consist of filtered day-light or lamp-light, is strictly non-actinic: by which is meant that the sensitive chemicals employed are not affected by it. Many of the lamps sold for this purpose are safe enough, unless very rapid plates are used. Lately a new medium has been introduced which is highly spoken of. It consists of a special green "cathedral glass" (to be obtained from most photographic dealers), backed up with two or three thicknesses of yellow paper. This medium admits plenty of light of a safe character.

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